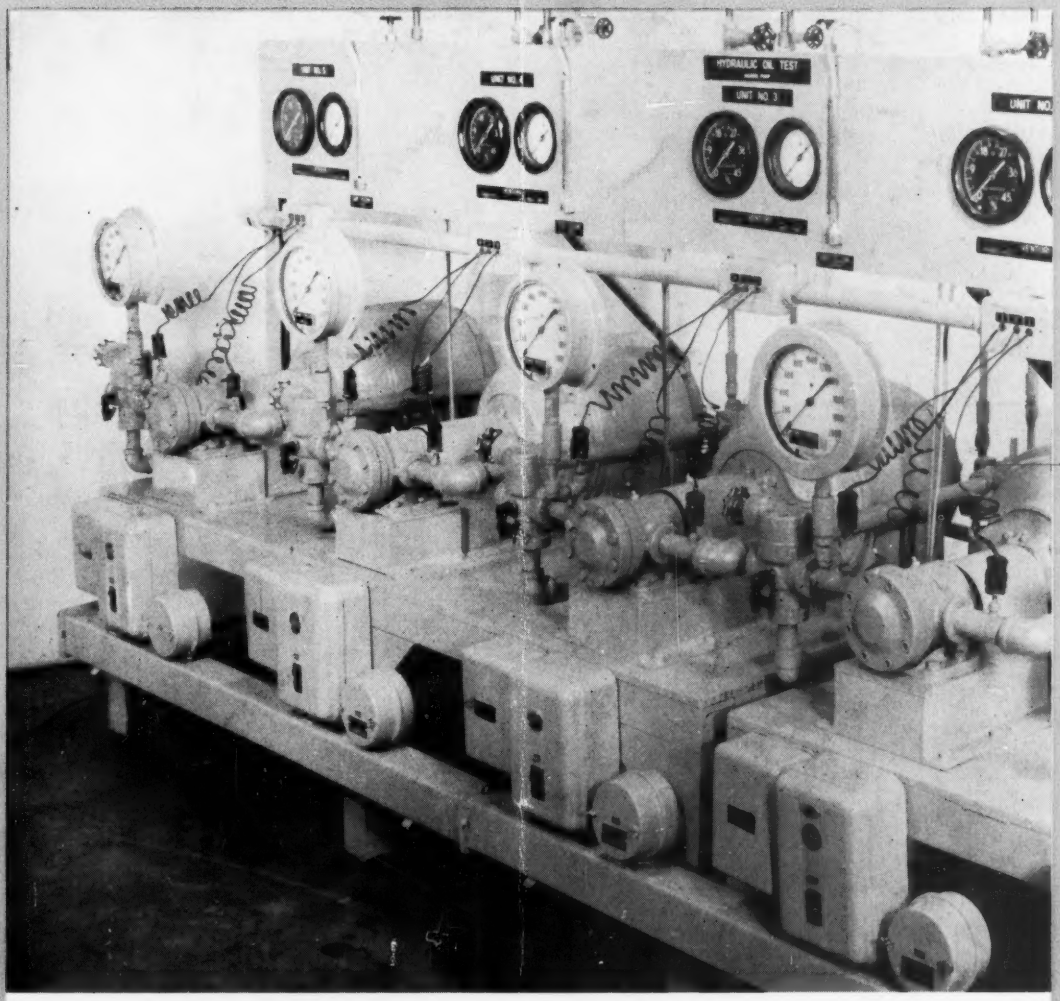
Vol. 15, No. 2 February, 1959

LUBRICATION ENGINEERING

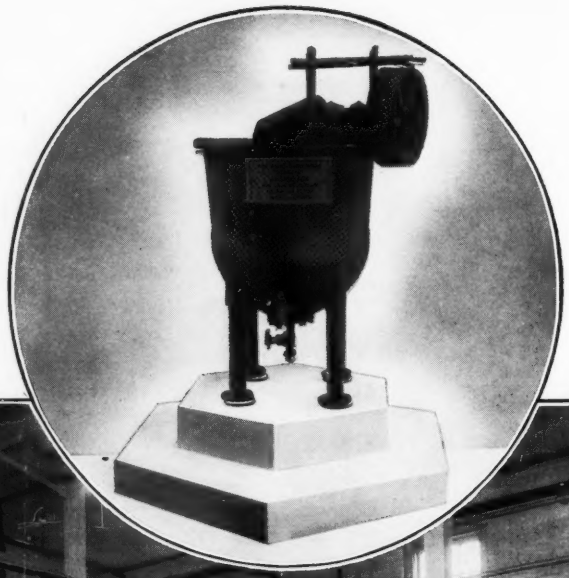
DESIGN RESEARCH APPLICATION EDUCATION MAINTENANCE



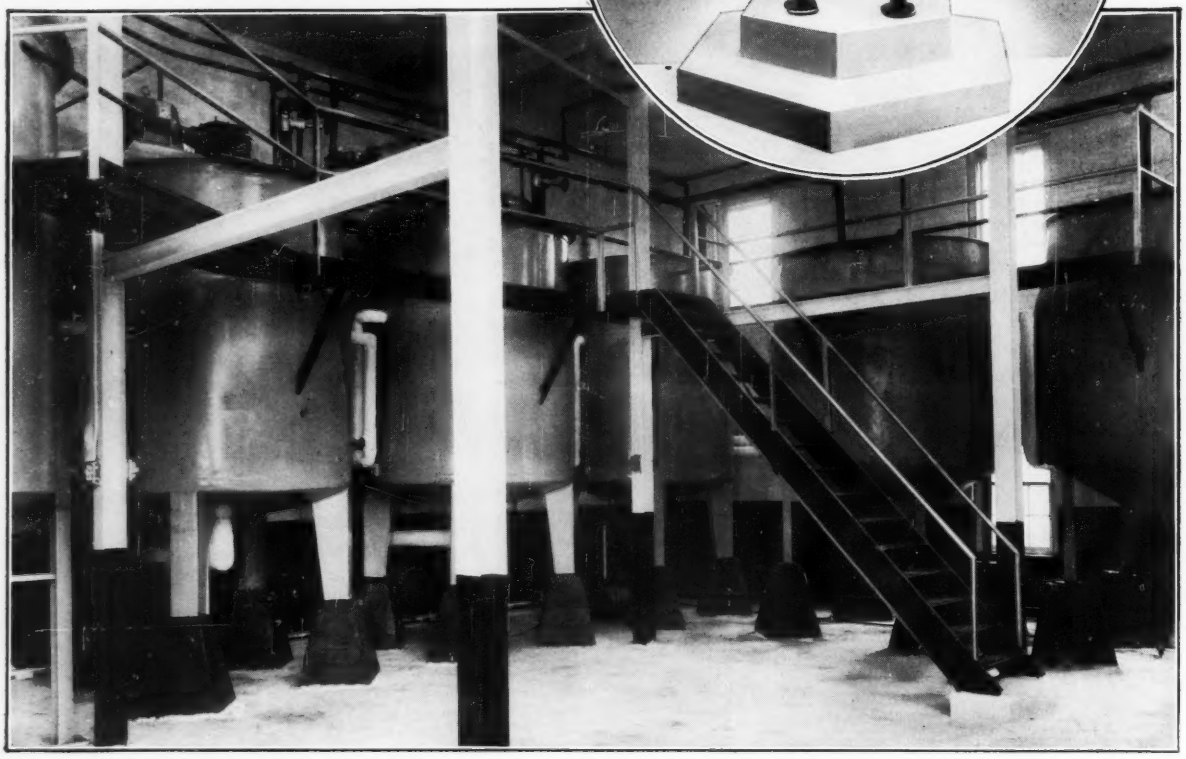
Hydraulic Pump Aids in Evaluating Fluids—(see page 64)

JOURNAL OF THE AMERICAN SOCIETY OF LUBRICATION ENGINEERS

CONCLUSIVE EVIDENCE



In the year 1932, the first batch of LEADOLENE was manufactured in the kettle shown in insert.



The increasing demand for Brooks Oil Company products, LEADOLENE . . . KLINGFAST . . . ROLLENE . . . BARCOTE made necessary the battery of modern, mammoth kettles, a section of which is pictured.

In serving industry for 83 years, The Brooks Oil Company has established an outstanding reputation for producing lubricants of the highest quality.

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The Brooks Oil International Company: Exporters

OFFICES AND WAREHOUSES IN PRINCIPAL CITIES U.S.A. • CANADA

Volume 15, No. 2
February, 1959

Lubrication Engineering

DESIGN RESEARCH APPLICATION EDUCATION MAINTENANCE

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Hot Oil Melts Snow From Toll Plaza

A hot-oil snow melting system is averting traffic jams at toll booths during the first winter's operation of Chicago's new $101,000,000 Calumet Skyway bridge.

Concealed beneath the concrete, a serpentine-grid network of welded carbon steel piping circulates 1100 gallons per minute of heated light oil to warm the roadway to 34-36 degrees Fahrenheit and keep the 22-lane toll plaza area free of ice and snow.

The system, first of its kind on a Chicago highway, covers an area of more than 58,000 square feet, giving cars from 120 to 160 feet of bare surface for slowing down and 40 feet in which to pick up speed again.

City officials say that with the combined use of welded piping and non-corrisive oil as the heat-exchange agent, the snow melting system should easily outlast the tollway itself without signs of deterioration. Numerous changes of direction and connections in the buried coils of pipe, as well as in the pipes leading from boilers to pumps to the road area, are made with welding fittings manufactured in Louisville, Ky. by Tube Turns Division of Chemetron Corp., Chicago. This type of fabrication, officials say, permits unimpeded flow conditions for the heat-transfer oil and provides permanently leakproof connections that obviate future maintenance problems.

The oil used in the snow melting system is heated in heat exchangers to a maximum of 160F by steam from two 200-horsepower boilers located under the toll plaza. It is circulated to the road area through all-welded piping that starts at 8 in. diameter and is reduced to 5, 4, 3, 2, 1¼ and finally ¾ in. The snow removal system was designed by Consoer, Townsend & Associates, and the piping contractor was Chicago Conditionaire Company.

NLGI Sets Out On Second Survey

After an excellent reception to their first survey which showed that the industry produced more than a billion pounds of lubricants in 1957, members of the National Lubricating Grease Institute are now participating in a second survey on 1958's production of lubricating greases and fluid gear lubricants.

Members in this case are the manufacturing firms belonging to the Grease Institute. More than 95 per cent of the lubricating grease and fluid gear lubricants manufacturers belong to NLGI and more than 76 per cent of these replied in the 1957 production survey.

This year's survey will also include the Canadian member firms of NLGI. Canadian totals will be maintained separately from those of the United States.

NLGI tabulates the grand total of pounds produced rather than taking marketing figures, which might include sale and re-sale. Handling the operation for the second year is the management services division of Ernst & Ernst, national certified public accounts. All replies are anonymous and the information confidential. Once totals are reached, all four categories of NLGI membership are advised in the spring—manufacturers, suppliers, marketers and researchers.

Bactericide Use Cuts Machine Shop Health Hazards

Until last summer business was booming for Rock Valley, Iowa, physicians. Sick calls among 45 employees of the Kooima Machine Works, Inc., were increasing.

Mechanically, the company was a safe place to work, but bacteria growing in the cutting oils were causing serious problems. Where employees had small cuts or scratches on their skin, infection developed. Some employees had infections and eruptions that bothered them for weeks.

To kill bacteria and eliminate the infection problem, Kooima management decided to put a formulation containing a bactericide into the cutting oil. One pound of the product was added to approximately a gallon of warm oil and mixed for about 10 minutes to get the bactericide into solution. This mixture was made for 50 gallons of oil to be put in the machine coolant tank. The solution was added to a machine when the latter was warm and in production.

Since using this bactericide in the oil, workers at Kooima Machine Works have had no wound infections.

While many machine shops use cutting oil emulsions, Kooima prefers straight cutting oils in expensive automatic bar machines because the travel area of the ways do not gouge or score as they do when emulsions are used. Bearings and rollers also get a much better lubrication with straight cutting oils, Kooima officials feel.

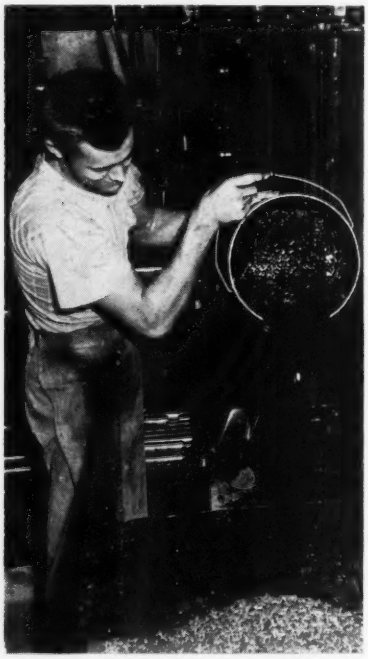
Moly Cast in Shape In Government Lab

Business Week reports that Bureau of Mines scientists have produced the first large-size casting of molybdenum to shape. It was a hollow cylinder 4.5 in. wide and 8 in. long, cast from a 30-lb. charge of molybdenum.

Its great strength at high temperatures makes molybdenum important in the aircraft, missiles, and chemical process industries, as well as in steel alloys. But this same virtue, a melting point of 4,748F, has frustrated previous attempts to cast it into shapes: The crucibles melted before the molybdenum did.

Scientists at the bureau's Albany (Ore.) laboratory finally got around this problem by using a high-density electric arc, operated by remote control in an inert atmosphere, to melt the molybdenum in a water-cooled, copper-lined pot. The molten metal was then poured through a series of troughs into a rotating graphite cylinder that forced it to the walls, where it consolidated into the cylindrical shape.

If the process can produce casts of specified shapes with the same strength and characteristics now achieved only by extruding, rolling, and machining, molybdenum components will be cheaper and quicker to make.



Infections from cutting oils increased constantly at an Iowa machine shop until a bactericide was added to the cutting oils.

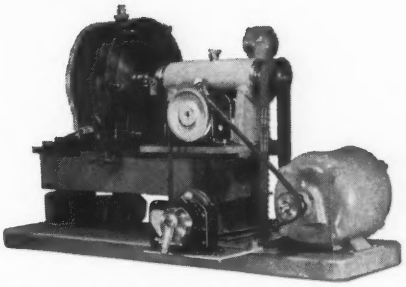
Automatic transmission seal problem—

New National Syntech® proves dependable answer in front pump seal position

Constant temperatures of 250°F, peaks of 300°, continual change in shaft speed, and total inaccessibility of the seal without costly teardown—these are a few of the sealing problems in the front pump of today's automatic transmissions for passenger cars.

To help meet this challenge, National engineers have produced a new oil seal. The new design, a steel encased, spring-loaded unit with Syntech synthetic sealing lip, is characterized by an unusually long flex section in the lip, a special, light-loading tension spring, and the time-tested, low torque Syntech lip itself.

Factory engineers report that the new National seals are proving extremely reliable in the application. Dealers also find the front pump seals are very reliable and do not require early replacement.



To design and thoroughly test the new seal, National engineers developed a new transmission simulator which exactly duplicates front pump operating conditions at all car speeds.

Get real help on seal engineering problems. Call the National Engineer.

NATIONAL SEAL Division, Federal-Mogul-Bower Bearings, Inc.

General Offices: Redwood City, California; Plants: Van Wert, Ohio, Downey and Redwood City, California

Large Crowd Is Attracted To First Gear Symposium

Part of the audience of more than 200 who attended the First ASLE Gear Symposium.

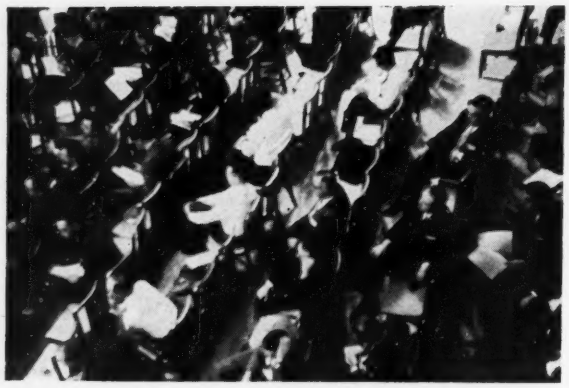
ASLE's first Gear Symposium was a tremendous success. That was the opinion voiced by many of those present at the two-day conclave at Chicago's Morrison Hotel.

Listening to 11 papers that ranged from highly practical to highly theoretical, the 217 in attendance gleaned much information from the material assembled by the Society's Gear and Gear Lubrication Technical Committee.

Lively discussion followed many of the presentations—Earle Ryder's paper, "The Gear Rig as an Oil Tester," provoked much comment from the floor.

Several of the Society's other technical committees are now considering conducting similar meetings on specialized subjects.

Mr. G. P. Maurer presents paper on "Recent Developments in the Lubrication of Heavy Duty Gearing."



A lively discussion and this rapt attention followed the paper presented by Earle Ryder.

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JULIAN KENNEDY'S *importance to steel making must be measured in millions of tons. When he was born, in the little town of Poland, near Youngstown, Ohio, in 1852, blast furnaces produced only a few tons of iron a day. Before he died he had far advanced the techniques by which one of today's big furnaces produces more than 500,000 tons a year.*

Nor was this all. Julian Kennedy showed the steel industry how to break old precedents, increase production and reduce costs in every phase of mill practice. More than 160 inventions, including blowing and reversing engines, hot blast stoves, blast furnace designs, charging devices, blooming mills and manipulators, poured from his mind. Every mill that he entered prospered — and he was connected with most of the important iron and steel plants in this country. No plant that he ever built failed to make a profit and pay for itself within a few years.

Great Names in Steel Making

The two traits that raised Julian Kennedy to greatness are still living in the men who produce steel ever faster and more efficiently.

The same impatience with the status quo, and eagerness to apply better products and processes, are seen in the mill superintendents, lubrication engineers and rollers who have recently extended the application of Ironsides' Palmoshield to achieve increased rolling speeds, not only in this country but in overseas mills as well.

This all-American roll lubricant was perfected by Ironsides during the Korean War as the long-sought replacement for imported palm oil. Within six months it was being used or tested in two-thirds of the major mills rolling tin plate. Steel men, appreciating Palmoshield's superior performance, and its availability as a domestic material, have since widened its application to the rolling of light and intermediate gauge sheet, long terne and coating lines as well.

Palmoshield is now proving helpful in the industry's continuing efforts to increase rolling speeds. In test after test "the palm tree that grows in Ohio" has been chosen to lubricate sheet being rolled at sustained speeds in excess of 4,300 fpm.

Palmoshield has all the desirable characteristics of palm oil, plus greater uniformity and the immeasurable advantage of being produced entirely of domestic materials, in the heart of the steel district. Chemical control is so close you can specify fatty acid content to ½%. There is no need for stockpiling. You are never dependent on overseas sources or vulnerable to artificial price fluctuations.

Ironsides engineers compound Palmoshield to suit the mill speed, method of application and individual preferences of each user, and guarantee that this "custom tailored" formula will not vary in uniformity thereafter. A letter or phone call will put their years of experience in successful cooperation with America's major rolling mills at your disposal. Address The Ironsides Company, Columbus 16, Ohio.

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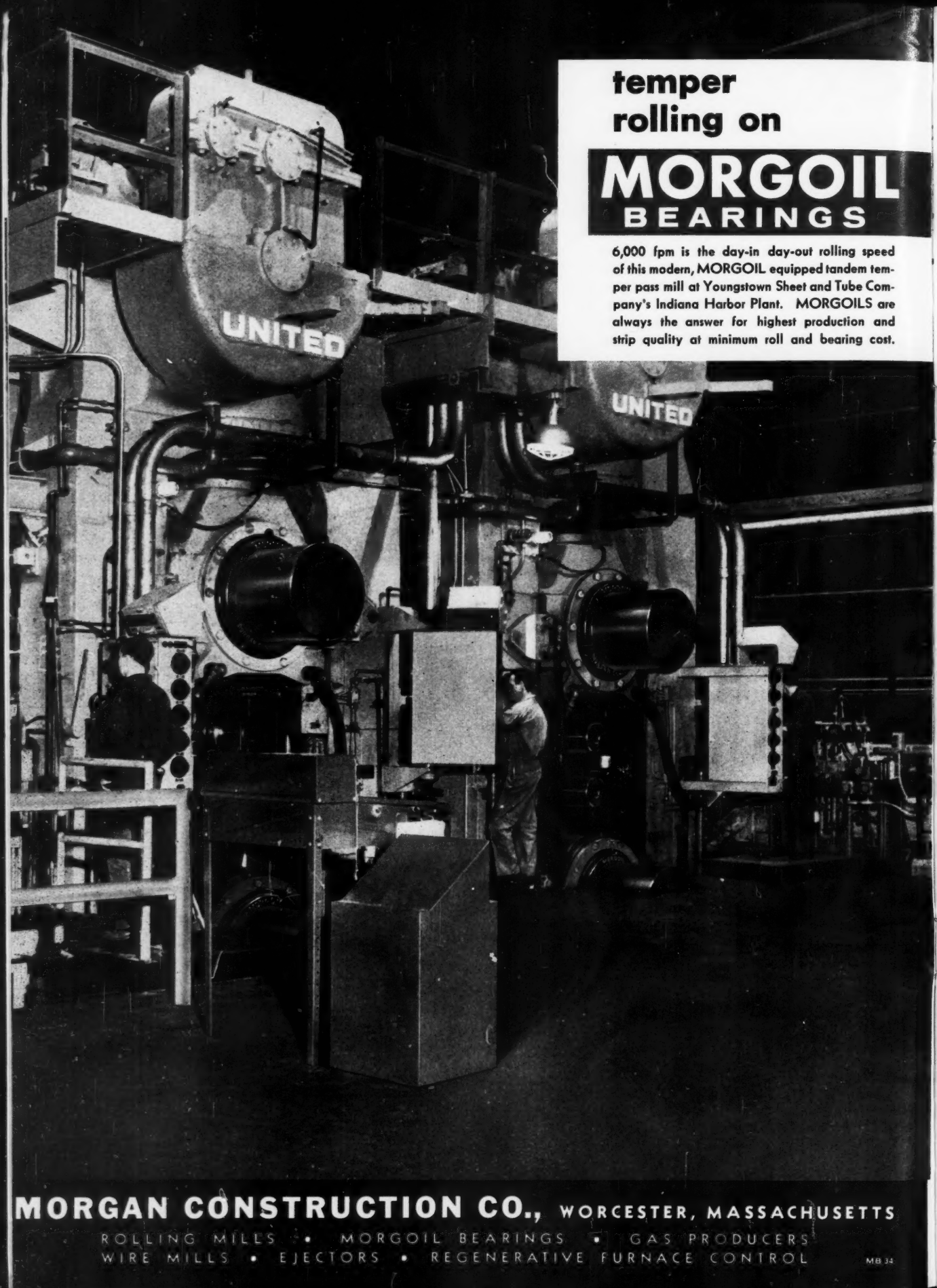

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6,000 fpm is the day-in day-out rolling speed of this modern, MORGOIL equipped tandem temper pass mill at Youngstown Sheet and Tube Company's Indiana Harbor Plant. MORGOILS are always the answer for highest production and strip quality at minimum roll and bearing cost.

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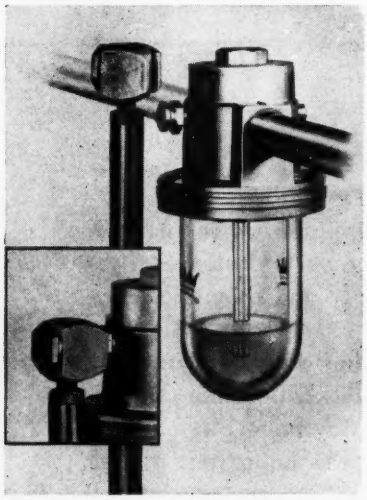
MB 34

NEW PRODUCTS

REMOTE-FILL DEVICE READY FOR AIR-LINE LUBRICATORS

A "remote-fill" device for air line lubricators has been announced by Hannifin Company, Des Plaines, Ill., a division of Parker-Hannifin Corporation. Designed



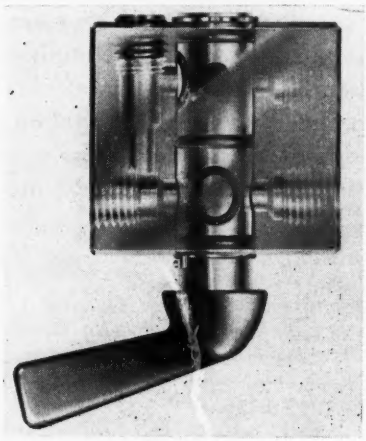
for use with standard model crown lubricators, it reportedly offers substantial savings in maintenance time by permitting quick filling of lubricator bowls, even in high and hard-to-reach places, without interfering with production. The device makes use of a specially designed button-head fitting that can be installed on either side of the lubricator body and a button-head coupler mounted on the end of a rigid extension of the oil delivery line. The two fittings are easily engaged by using the lubricator body flange as a guide. Oil is then forced from a portable hand pump through the delivery line and into the bowl. After filling, the two fittings are uncoupled by a simple upward movement of the extension; special provision is incorporated to eliminate dripping during and after disengagement. Complete "remote-fill" systems are available as well as any of the components from lubricators to hand pumps. Additional information about this new remote-fill device is available from Hannifin Company, Dept. 312, Des Plaines, Ill.

LOW PRESSURE COUPLINGS

A new line of low pressure "Hold-Fast" couplings is designed for general, low pressure, hydraulic and fluid transfer service in the industrial, automotive and agricultural fields. Because attachment or removal from the hose is reportedly accomplished quickly and easily, without the use of tools, the new couplings are well adapted for fast, emergency field repair. A wide range of styles and sizes is available, including couplings suitable for virtually every general, low pressure application. As they are reusable, their adoption permits substantial economies and minimum replacement inventory requirements. Assembly is quick and uncomplicated, since the hose is simply forced over the stem until it seats against the bottom of the protective cap. To complement these new low pressure couplings, Anchor is introducing two new styles of low pressure, 1-cotton braid hose. A new supplement to Anchor's Catalog 302 gives complete descriptions of the new coupling and hose. Copies may be obtained by writing Anchor Coupling Co. Inc., 342 N. Fourth St., Libertyville, Ill.

THREE-WAY PLUG VALVE

A new 9300 series 3-way plug valve featuring leakproof shutoff and preventing external and body leakage is now available from Circle Seal Products Company. Unique design also permits



the valve to provide minimum pressure drop. Use of a unique sealing principle with O-rings on the face of a cylindrical plug and on the diameter of the plug produces effort-free operation and maintenance-free service life without adjustment. The new general purpose valve for both gas and liquid circuits has three ports arranged as 3-way valves to provide one inlet, one outlet and an exhaust either piped or atmosphere. The new 9300 valve provides either one inlet and two outlets or two inlets and one outlet when functioning as a selector valve. Typical applications for the new valve include test benches, pilot and process plants, pneumatic and hydraulic equipment and plant air circuits. An illustrated data sheet showing the operation of the 9300 valve and details such as its operating temperatures of —40 to 250F and operating pressures of —14.7 to 150 psi is available from Circle Seal Products Company, 2181 E. Foothill Blvd., Pasadena, Calif.

Lubriplate No. 630-2 is a high temperature, extreme pressure, water-repellent, grease type lubricant. Ideal for the general lubrication of Industrial, Automotive, Construction, Farm and Marine Equipment. Lubriplate Grease Gun Cartridges provide an easy, quick, economical means of application. Prevent the waste and mess of hand filling. Packed 10 Cartridges in a handy carrying carton.

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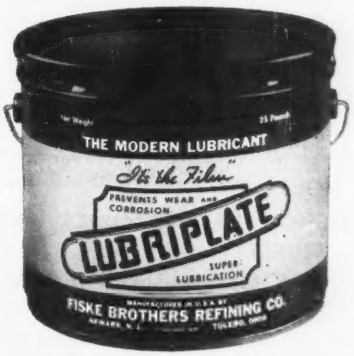


Start making plans now for

THE 1959 ASLE ANNUAL MEETING
April 21, 22, 23, 1959
Hotel Statler
Buffalo, New York

The importance of lubrication is becoming more and more apparent to industry in this age of space exploration and missile development. The very existence of today's complex mechanisms is wholly dependent upon proper and scientific lubrication.

New techniques as well as new materials are constantly being developed to cope with high temperature problems. Resistance to radiation is quickly becoming an important factor in lubricant specifications. Other problems which have plagued the lubrication engineer are being more closely scrutinized in the hope that at last there may be answers to them.

The 1959 Annual Meeting promises to shed new light on many lubrication problems. Listed here is a tentative program which outlines the up-to-the-minute subjects to be covered at this timely meeting. Look it over and you are sure to find that you can't afford to miss being there.

Tuesday, April 21, 1959

Morning **Registration**
Annual Meeting

SESSION 1A 2:00-5:00 p.m. LUBRICATION FUNDAMENTALS

Fred Villforth, Texaco Research Center, Beacon, New York, Organizing and Session Chairman.

1. "Evaluation of Dry Powdered Lubricants at 1000°F. in a Modified Four-Ball Wear Machine."
   C. M. Allen, L. B. Sibley, S. L. Cosgrove, Battelle Memorial Institute, Columbus, Ohio.
2. "Consideration of Lubricants for Temperatures above 1000°F."
   M. B. Peterson, J. J. Florek, S. L. Murray, General Electric Company, Cincinnati, Ohio.
3. "The Lubrication of Solids at High Temperatures."
   Barry L. Mordike, University of Cambridge, England.
4. "High-Temperature Friction and Wear Properties of Bonded Solid Lubricant Films Containing Lead Monoxide."
   R. L. Johnson, H. E. Sliney, NACA, Cleveland, Ohio.

SESSION 1B HYDRAULICS AND HYDRAULIC MACHINERY

A. S. Morrow, Shell Oil Company, New York, Organizing and Session Chairman.

1. "Hydraulic Fluids in the Steel Industry." L. R. McDonald, Wheeling Steel Co., Steubenville, Ohio.
2. "An Operational Test of a Fire Resistant Fluid (Phosphate Ester Base) for Lubrication of Journal Type Bearings." E. J. Tullos, Union Carbide Nuclear Co., Paducah, Ky.
3. Film by General Motors Technical Center on their work in the fire-resistant hydraulic fluid field.

SESSION 1C GENERAL SESSION

1. "Spur Gear—Hertzian Contact Times."
   E. K. Gatcomb, R. P. Hunnicutt, G. S. Kinney of U. S. Naval Post Graduate School, Monterey, Calif.
2. "Conditioning of Vacuum Pump Oils."
   G. Topol, S. F. Bowser Co., Hamilton, Ontario, Canada.
3. "Friction, Stiction and Fiction."
   R. K. Sedgwick, Kearney & Trecker, Milwaukee, Wis.
4. "Cam and Tappet Lubrication IV—Radioactive Study of Sulfur in the E. P. Film."
   E. H. Loeser, R. C. Wiquist, S. B. Twiss, Chrysler Corporation, Detroit, Mich.

Wednesday, April 22, 1959

SESSION 2A 9.00 a.m. FLUIDS FOR METALWORKING

Marco Petronio, Frankford Arsenal, Philadelphia, Pa. Organizing and Session Chairman.

1. "Test Procedures for the Evaluation of Cutting Fluids."

R. J. Yanis, G. F. Wolfe, General Electric, West Lynn, Mass.

2. "Two Measurement Techniques Used in the Evaluation of Cutting Fluids."
   J. R. Muenger, N. C. Derby, Texaco Research Center, Beacon, N. Y.
3. "New Developments in Metal Working."
   E. L. H. Bastian, I. Rozalsky, K. F. Schiermeier, Shell Oil Company of New York.
4. "Lubricants for Metal Displacement."
   S. J. Barber, E. F. Houghton, Philadelphia, Pa.

SESSION 2B PROPERTIES OF LUBRICANTS—GREASES

E. O. Forster, Esso Research and Engineering Co., Linden, N. J., Organizing and Session Chairman.

1. "Structure and Flow Properties of Some Greases," Professor H. Eyring, University of Utah.
2. "Flow Properties of Lithium Stearate-Oil Model Greases as Functions of Soap Concentration and Temperature."
   W. H. Bauer, A. P. Finkelstein, S. E. Wiberley, Rensselaer Polytechnic Institute, Troy, N. Y.
3. "Effect of Thickener-Particle Dimensions on Lubricating Grease Properties." R. H. Leet, A. C. Borg, Standard Oil Company, Whiting, Indiana.
4. "New Concepts in EP Greases."
   C. L. Knapp, Esso Research & Eng., Linden, N. J.
5. "Sheer Stability of Lubricating Greases vs. Lubricating Performance."
   C. J. Boner, Battenfeld Grease-Oil Corp.

SESSION 2C STEEL INDUSTRY COUNCIL

R. E. Forsythe, Steel Company of Canada, Hamilton, Ontario, Canada. Organizing and Session Chairman.

1. "Low Shear Rate Grease Mobility."
   Eldon L. Armstrong, Socony Mobil Oil Co., Brooklyn, N. Y. John Simon, National Tube Division U. S. Steel, McKeesport, Pa.
2. "Reducing Leakage from Hydraulic Systems."
   Robert Q. Sharpe, Socony Mobil Oil Co., New York.
3. "Practical Discussion of Lubricating Oils and Greases."
   N. R. Hostler, Tidewater Oil Co., New York.
4. "Specification of Circulating Oil Systems."
   J. B. Kirschner, Wheeling Steel Co., Wheeling, W. Va.

SESSION 3A 2:00 p.m. FLUIDS FOR METALWORKING

A. W. Ackerman, F. E. Anderson Oil & Chem. Co., Middletown, Conn.
Organizing and Session Chairman.

1. "Important Factors In The Selection and Use of Water Soluble Cutting and Grinding Fluids."
   C. A. Sluhan, Master Chemical Corp. Toledo, Ohio.
2. "Controlling The Spoilage of Water Soluble Cutting Fluids."
   C. D. Flemming, R. J. Baker of Socony Mobil Oil Company.
3. "Coolant Microbiology: The Role of Industrial Research."
   E. D. Kitzke, R. J. McGray, S. C. Johnson & Son, Inc., Racine, Wisconsin.
4. "Emulsifiable Rust Preventives."
   H. B. Carpenter of Esso Standard Oil Company of New York.

SESSION 3B PROPERTIES OF LUBRICANTS—OILS

C. N. Rill, The Murphy-Phoenix Company, Cleveland, Ohio, Organizing and Session Chairman.

1. "Rapid Determination of Heat Capacity of Liquids over Extended Temperature Ranges."
   J. W. Barger, C. C. Bolze, R. L. Hughes, T. M. Medved, Midwest Research Institute, Kansas City, Mo.
2. "Characteristics of Man-Made Fluids."
   R. K. Smith, W. Eismann, Jr., E. F. Houghton, Philadelphia, Pa.
3. "Evaluation of Long Chain Phosphorus Compounds as Lubricity Additives."
   J. Messina, Louise Peale of U. S. Army Ordnance Corps., Pitman-Dunn Lab., Frankford Arsenals, Philadelphia, Pa. and B. Ackerman, R. Sasin, Association of American Soap and Glycerine, New York, N. Y., and Daniel Swern of Eastern Regional Research Lab., Philadelphia, Pa.
4. "The Contribution of Polymers to Oil Properties Important to Engine Lubrication."
   J. M. Musselman, S. M. Darling, Standard Oil of Ohio.
5. "The Heat of Adsorption of a Boundary Lubricant."
   E. P. Kingsbury, Massachusetts Institute of Technology, Cambridge, Mass.

SESSION 3C NATIONAL RAILROAD LUBRICATION COUNCIL

Wm. M. Keller, Association of American Railroads, Chicago, Ill., Organizing and Session Chairman.

1. "Behavior of Viscosity Index Improvers in Lubricating Oil."
   Robert Byrne, Association of American Railroads, Chicago, Ill.
2. "Progress in Roller Bearing Lubrication."
   O. J. Horger, Timken Roller Bearings, Canton, Ohio.
3. "Developments in Railroad Journal Bearings."
   M. A. Hanson, Magnus Metal Co., Chicago, Ill.
4. "Infrared Hot Box Detection."
   Wm. Pelino, D. M. Key, Jr., Servo Corporation of America, New Hyde Park, Long Island, N. Y.

Thursday, April 23, 1959

SESSION 4A 9:00 a.m. BEARINGS AND BEARING LUBRICATION—SLIDING BEARNGS

Robert Davies, General Motors Technical Center, Detroit, Mich. Organizing and Session Chairman.

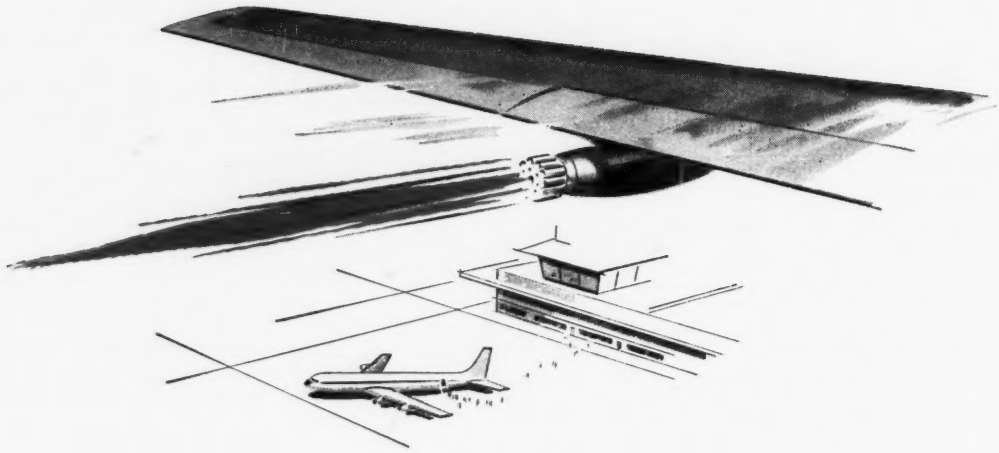
1. "The Finite Fitted Partial Journal Bearing."
   M. Jacobson, E. Saibel, Rensselaer Polytechnic Institute, Troy, N. Y.
2. "A Theory of Boundary Lubrication."
   Dr. A. Cameron, University of London, England.
3. "Effects of Fluid Film Pressure on Hydrodynamic Lubrication."
   N. Tipei, Institute of Applied Mechanics, Bucharest, Romania.

SESSION 4B ENGINE LUBRICATION

C. M. Floyd, Humble Oil & Refining Co., Baytown, Texas, Organizing and Session Chairman.

1. "Lubrication of Air-Cooled and Water-Cooled Two Stroke Cycle Engines."
   L. E. Haas, McCulloch Corp., Minneapolis, Minn.
2. "Lubrication: Sez Who?"
   R. L. Churchwell, F. J. Kokas, Tennessee Gas.

(Cont. on p. 71)



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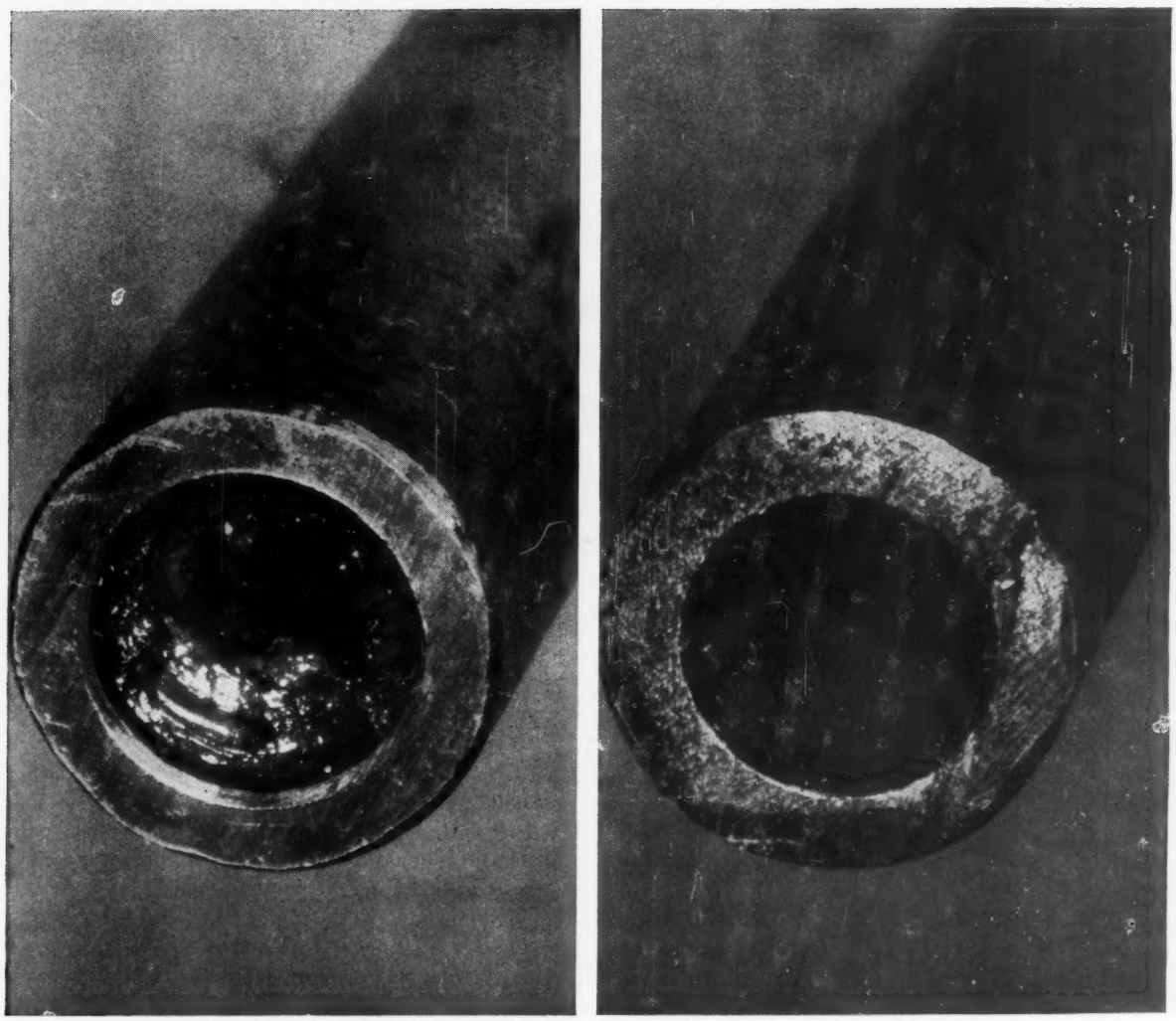

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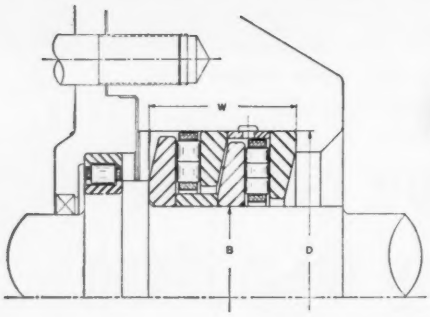

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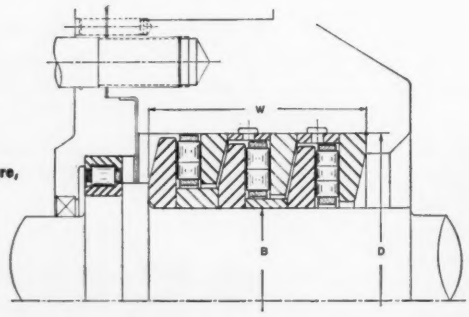

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Lube Lines

by A. F. Brewer*

BUILT-IN LUBRICATION

As a function and property of the bearing material, the extent to which built-in or reserve lubrication is provided depends upon the type of material. It can be a natural property, as in the case of high-lead babbitt metal, graphited metals or certain synthetics such as fluorocarbon resin, or it can be developed in the course of fabricating the material by the direct inclusion of lubricant, as in the oil-impregnated porous bearing metals which are the products of the science of powdered metallurgy.

THE SIGNIFICANCE

"Built-in" can be interpreted in many ways. Basically it signifies an inherent quality or characteristic. The modern concept of design is to include in one package, so to speak, those features which lead to most dependable service. All of our modern household appliances are significant examples. The push-button has become as accepted a symbol of modern utility as the tallow pot was to our lubrication forebears, when it became a counterpart to the development of the steam engine.

Later, technical ingenuity resulted in more concentrated study of the mechanism of lubrication and the perfection of devices to enable lubricants to function more dependably than they did in the tallow pot age. Patent records are unique in portraying the thoughts of contemporary designers as far back as a hundred years ago. This was not too long after the inventive genius of Isaac Babbitt produced his basic contribution to lubrication in the form of babbitt metal.

The efforts of these pioneers in the study of means of lubrication were directed towards the mechanics of the problem. The idea that chemistry might play an important part did not occur to them, nor did Babbitt himself possibly realize that his babbitt formula had much lubricating value by itself. Such contributors were interested chiefly in "how to do it." From various ideas for lubrication in axle and journal service by adaptation of the oil cup principle, the records indicate that the researchers progressed to gravity feed, and on to other systems designed to decrease the need for operator attention.

RESERVE INSURANCE VALUE

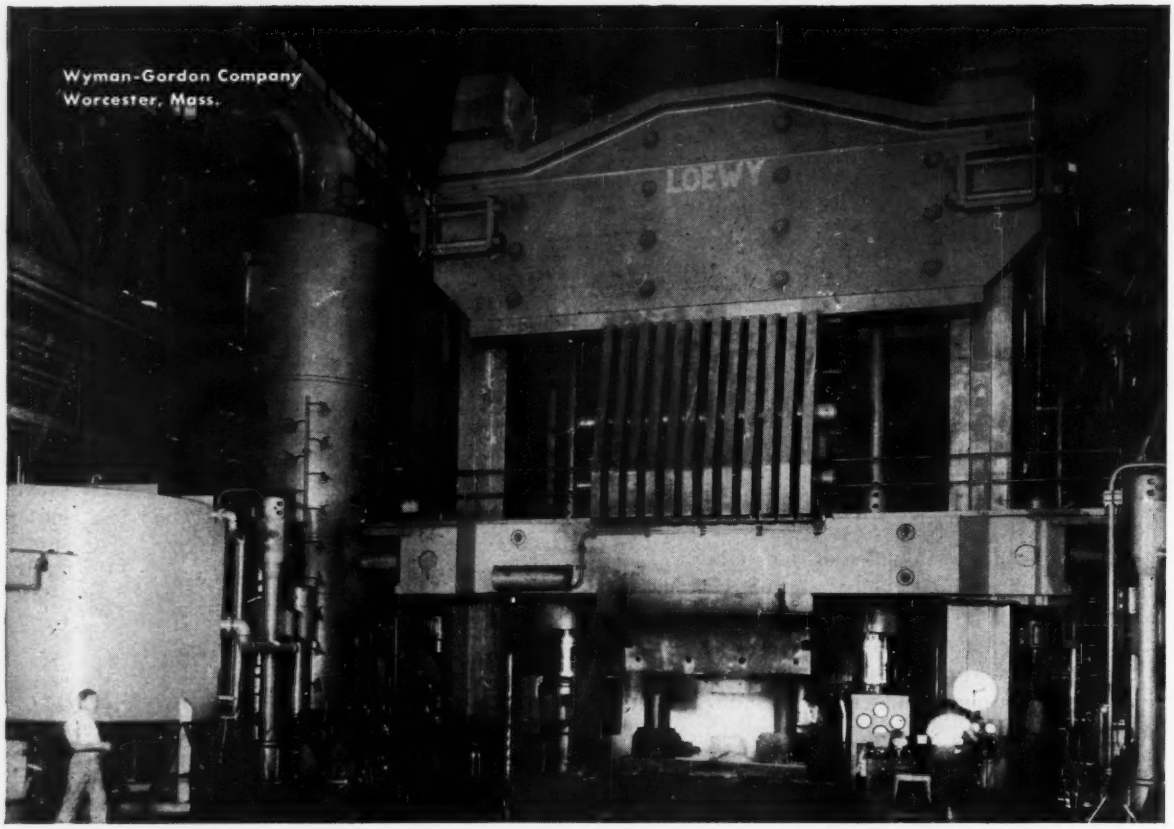
Obviously if there is a degree of build-in lubrication apart from the actual lubricating procedure or system of application, a degree of reserve insurance value prevails. It can be a most valuable feature. This is not to infer that a bearing material always must be possessed of some degree of built-in lubrication. The use of the available materials must be studied with due consideration of the operating conditions. Lead-base babbitts have relatively low corrosion resistance when exposed to certain petroleum acids. Porous bearing metals can be limited as to temperature and speed. Some graphited metals have low load-carrying ability. Certain of the resins may have limitations as to maximum temperature or susceptibility to certain chemicals.

There are very definite types of service to which these materials are best suited. The accompanying table of characteristics can be useful in any study of applicability. By fitting the type of material to the service conditions and the method of lubrication (or re-lubrication) maintenance, the most positive benefits can be obtained and the economic value of the specific material will be most pronounced.

TABLE OF CHARACTERISTICS OF BEARING MATERIALS WITH BUILT-IN LUBRICATING ABILITY

	AVERAGE LOAD CARRYING ABILITY MAX. PSI	AVERAGE MAXIMUM SAFE OPERATING TEMPERATURE °F.	AVERAGE MAXIMUM OPERATING SPEED FT./MIN.
Lead-base Babbitt	1500	270	4000
Porous Metals	4000	150	1500
Graphited Metals	600	700	2500
Fluorocarbon Resins	40,000	500	1000

* Consultant and author "Basic Lubrication Practice."



Operation Big Squeeze:

World's largest presses lubricated by Cities Service Pacemaker Hydraulic Oils

Once a forging operation for horse-drawn carriages, Wyman-Gordon Company now operates the world's largest presses, with the newest one capable of exerting 50,000 tons pressure.

Reason for this tremendous press is the increasing need for strong, lightweight metal parts for aircraft. Today, as for many years, no military or transport aircraft takes to the air without Wyman-Gordon forgings.

With its huge, hydraulically operated presses, Wyman-Gordon is able to forge huge pieces with one big squeeze. Sometimes a whole unit for a landing-gear strut. Or one mammoth wing spar.

The press that exerts 50,000 tons pressure is described by Wyman-Gordon as "the largest single machine ever conceived"—and few people would argue the point after seeing it.

Mounted in a pit that extends nine stories beneath the earth, the giant press is over 114 feet high and weighs 10,605 tons, 6,450 of which moves up and down.

Cities Service is justifiably proud that here as in all of Wyman-Gordon's presses with 18,000 tons pressure or better, hydraulic lubrication is provided by Cities Service Pacemaker Oils.

It is hardly necessary to point out the incredible demands that such machinery makes of its hydraulic lubricants... and certainly it is self-evident that if Cities Service Pacemaker Oils can perform satisfactorily in the world's largest presses, they'll do the same for you. Talk with a nearby Cities Service Lubrication Engineer. Or write: Cities Service Oil Co., Sixty Wall Tower, New York 5, N. Y.

Entire Rig Is Operated by One Man with the few simple controls shown here. With a flick of his fingers he can put on a squeeze of 50,000 tons. Result is extremely strong lightweight forgings for aircraft.

Lubrication Foreman has mammoth responsibility. Here, he checks dispenser for Cities Service EP 20 Lubricant... used on main bed and columns of large presses and other areas subject to extreme pressures.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Vol. 15, No. 2

Lubrication Engineering

a success and a challenge

A "first" of anything is never an end in itself. It merely marks the beginning of bigger and better things to come. The first automobile could never hope to compete with one of today's sleek models, nor could Fulton's first steamboat stack up well against the Queen Mary. Still, those humble beginnings were the form and substance upon which these later dreams could be built.

Our Society also marked an important "first" last month. It sponsored its first Gear Symposium, holding such a specialized conference for the first time. Obviously this meeting filled a very real need, for well over 200 people from all parts of the country, as well as from foreign countries, attended the two-day conference at Chicago's Morrison Hotel. Many of the papers provoked lively discussions, discussions which will be considered for publication at the time the Gear papers are published.

This symposium was sponsored by the Gear and Gear Lubrication Technical Committee of the Society. The Society gratefully acknowledges the tremendous job done by the committee and its chairman, Dr. T. W. Havely. One would think that the amount of effort that goes into an undertaking of this sort would tend to discourage further committee participation in such projects. Such is not true, however. Instead, other Technical committees and Industrial Councils of the Society are already looking forward to planning other specialized conferences, hoping to duplicate, and even better, the success of this important "first." We hope that many more such projects will be undertaken and that successful meetings of this nature will become rewarding events, and routine events, for ASLE.

C. L. Willey, Exec. Sec.

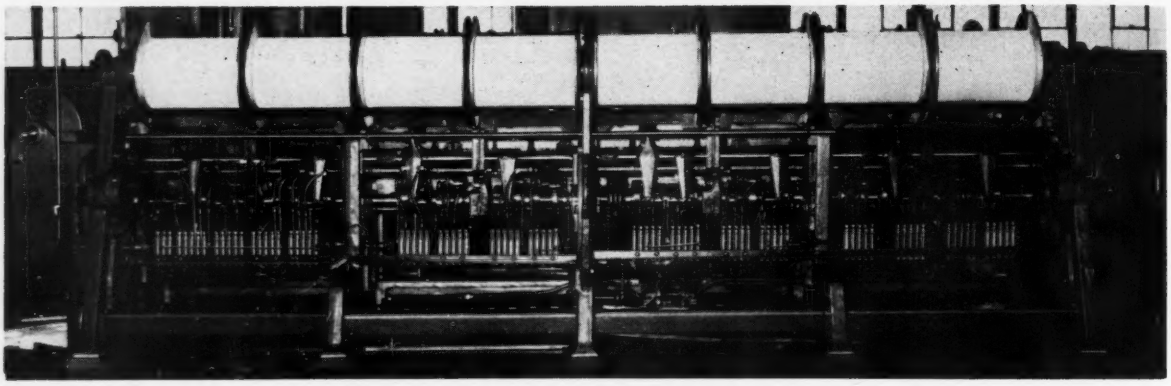


Fig. 1. Centralized lubrication on tricot machines.

Economics of Automatic Power Lubrication in the Textile Industry

Clyde E. Moss

Firestone Textile Div., Firestone Tire & Rubber Co., Gastonia, N. Car.

Only 20 per cent of United States' textile mills have engaged in any extensive modernization program. The remaining 80 per cent must modernize to meet the demands of a growing population.

Marginal mills are marginal chiefly because they overlook the importance of modern productive maintenance and modern lubrication methods. $10 billion dollars are spent annually for productive maintenance, an occupation which engages 1,250,000 workers or one out of every 12 employees in American industry.

The need for automatic lubrication is fast becoming a necessity. Old lubrication methods—the oil can, the grease gun, the grease swab—are the most expensive instruments in the hands of labor today.

CENTRALIZED LUBRICATION IN THE TEXTILE INDUSTRY

The year 1958 ushered in a strange paradox with respect to the textile industry. We were confronted on one hand with the documented and authoritative statement by Professor B. L. Whittier, head of the department of fabric development, School of Textiles, North Carolina State College, to the effect that "U. S. consumption of textiles will reach the unprecedented rate of 9 billion pounds per year by 1975, and if the national economy is maintained anywhere near its present level, there can be no other way except up for the textile industry."

On the other hand we have an equally authoritative statement from the *Daily News Record,* one of the leading business papers serving the industry, stating that "mill survival depends on modernization" . . . and that "at the present rate of production and sales, there soon won't be enough spindles to take care of normal textile demand."

Here is an economic problem in one of the nation's oldest and most basic industries that calls for prompt and decisive action. The key to the problem is mill modernization and sound productive maintenance. It is true that large sums of money have been invested in mill machinery and plant modernization since the end of World War II. But this expenditure covers only 20 percent of the entire textile industry. That leaves 80 percent of the industry that must modernize to stay alive in the competitive markets of today and tomorrow. And here, too, is an interesting parallel—only 20 percent of the industry is taking advantage of the proven multiple benefits of automatic power lubrication systems and the tremendous competitive advantage which they afford.

NEED FOR MODERN LUBRICATION METHODS

The question might well be asked, "Just how important are modern productive maintenance and modern lubrication methods, specifically in the overall industrial picture?" Perhaps the best answer is that a substantial part of the overall cost of plant or mill maintenance can be attributed directly to faulty lubrication. This overall cost is about equal to the dividends the stockholders receive, an estimated $10 bil-

Presented at the Annual Meeting of the American Society of Lubrication Engineers held in Cleveland, Ohio, April 1958.

lion annually with costs rising steadily at the rate of $1 billion per year. In addition, the *Chicago Tribune* states that about 1,250,000 workers, or one out of every 12 employees, are engaged in maintenance. The wages of maintenance workers alone, says the *Tribune,* will cost industry over $5.5 billion annually.

A second question might now be asked: "Why this steadily increasing cost for maintenance and lubrication in particular?" Howard F. McCullough, a service shop general manager, explains that the nine per cent yearly increase in maintenance costs is based on an increasing industrial trend toward the use of automation, or automatic methods, for continuous processes.

The textile industry is no exception in following this trend toward the use of automated production methods. Consequently, with increasing emphasis on quality control and with machines precision built to operate at greatly increased speeds, designed to carry heavier loads and equipped with electronic and hydraulic controls, the need for *automated lubrication* has become a positive necessity and a competitive operating advantage that cannot be ignored.

For example, traveler speeds today may go as high as two miles a minute, and one-¾ miles per minute is not uncommon. Therefore, it becomes obvious that the lubrication methods that were introduced 40 years ago, namely the oil can, the grease gun and grease swab in the hands of an oiler with all the inherent time, labor and cost-consuming disadvantages, are completely inadequate to meet the requirements of modern machines and can no longer be relied upon, or even tolerated.

The manufacturers of lubricant application systems are not only meeting the need for automatic, power-operated devices, but are anticipating the requirements for even more advanced systems. As proof, the catalogs of these manufacturers, illustrating a wide selection of centralized lubrication systems, would fill a good size bookcase. It is not the purpose of this article to describe the operating characteristics of these systems or to weigh the advantages of one type of system over another. Rather, the objective is to illustrate how modern power lubrication is solving mill operating problems. In order to accomplish this, it is necessary to know what the major problems are in textile mills before lubrication engineers can aid in their solution.

ADVANTAGES OF MODERN LUBRICATION METHODS

A survey of mills throughout the east coast indicates that maintenance men have many problems which could be minimized or eliminated by adoption of automatic power lubrication systems. Some of these problems are:

1. Material spoilage caused by staining from grease and oil which results in high waste expense and excess labor costs for spotting.
2. Excessive wear on machine parts resulting in high replacement, maintenance and downtime costs. This is particularly serious with rings, travelers, spindles, cams and borized bearings and associated journals.
3. High rust and corrosion of machines operating under severe humidity conditions.
4. Difficulty in properly lubricating equipment operating under high temperature conditions such as tenter frames and calenders.
5. Bad housekeeping conditions and constant fire hazard caused by excess oil drippage and "fly."
6. Stocking too great a number and variety of lubricants for servicing equipment.
7. Excessive power consumption due to machine bearing friction.
8. High compensation costs to employees injured in accidents attributable to manual lubrication.

There are, of course, numerous other isolated problems. However, the aforementioned are currently foremost in the minds of mill operating personnel.

The following illustrates how automatic power lubrication systems are solving these eight problems throughout the more aggressive 20 per cent of the industry which has installed them.

1. *Material spoilage and waste expense.*

Centralized lubrication systems eliminate this problem almost entirely as the systems are completely sealed from source to bearing. In addition, these systems reduce reject waste by eliminating inaccuracy of machine operation and misalignment of moving parts caused by insufficient or improper lubrication.

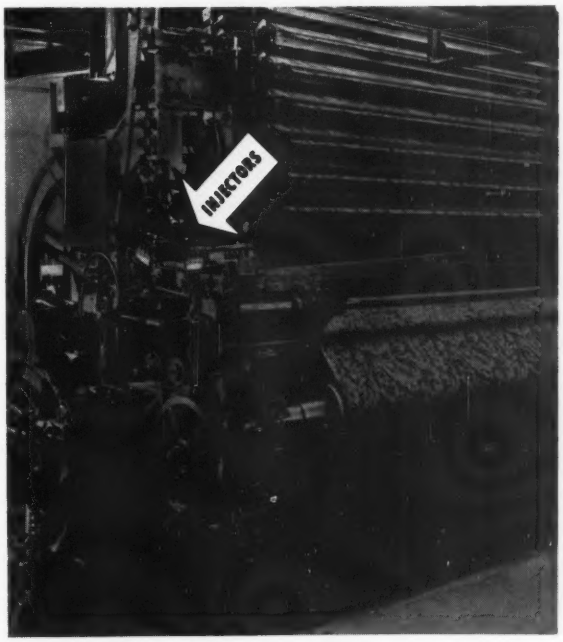


Fig. 2. Centralized lubrication on rug loom.

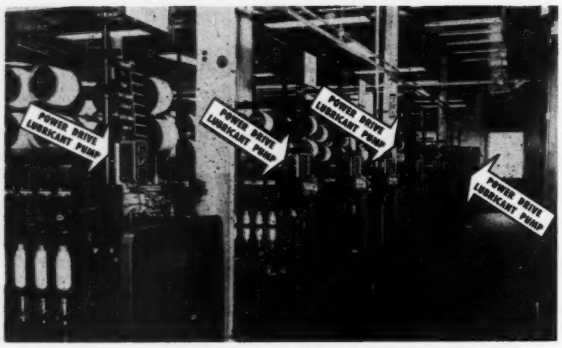


Fig. 3. Automatic ring lubrication on twister frames, showing time-clock control of power drive lubricant pump.

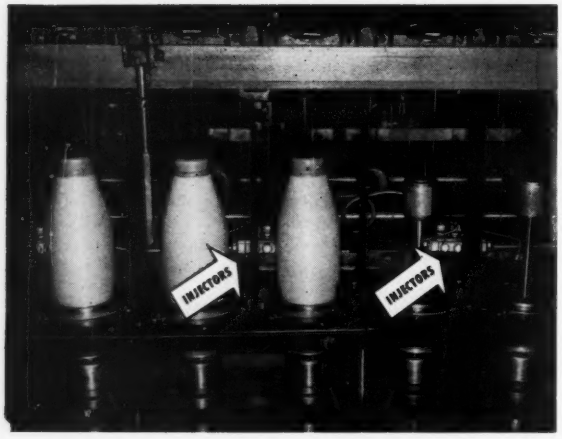


Fig. 4. Automatic ring lubrication on twister.

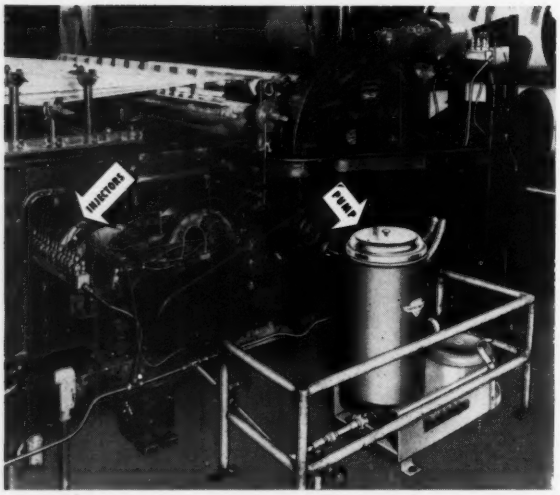


Fig. 5. Automatic lubrication on slasher.

2. *Excessive parts replacement, maintenance and down-time costs.*

This is certainly a category where centralized systems have effected spectacular savings. For example, one of the world's leading carpet mills in the east installed automatic lubrication systems on 107 machines. The Director of Engineering made the following statement: "As we see it, there are two big bonuses in automatic lubrication:

a. *Peace of mind.* That's right. You might call it positive, controlled lubrication. But it's our way of saying that we no longer have to worry whether or not each bearing gets the right amount of lubricant, in the right place, at the right time. And some of our machines have over 200 lubrication points.

b. *A handsome profit.*

Savings in labor, materials, and machine downtime paid for this installation in less than a year." Here is a typical record of savings effected on a carpet loom in a single year:

AUTOMATIC LUBRICATION COST vs. SAVINGS

TOTAL INSTALLATION COST (INCLUDES LABOR, MATERIALS, AND OVERHEAD, BUT NOT LOSS OF PRODUCTION CAUSED BY INSTALLATION DOWN-TIME) $1200.00

ANNUAL SAVINGS	PER LOOM	% SAVING
Labor (oilers)	$ 140	90%
Lubricant	40	30
Production downtime		
for lubrication	608	100
for repairs, etc.	409	20
Maintenance and repair of looms		
labor	45	20
parts, tools, etc.	500	10
	$1742	
Increased machine life		
machine		15
wear parts		30
Product spoilage		25

3. *High rust and corrosion of machines.*

Automatic, time clock controlled lubrication systems can be a distinct advantage in solving this problem as they constantly maintain a protective film on bearings, both during operation and idle periods. The use of highly polar stable lubricants which will preferentially replace moisture on metallic surfaces, and/or the use of rust inhibited type lubricating oils adds further aid in over-coming the deteriorating effects of high humidity.

4. *Difficulty in properly lubricating equipment operating under high temperatures.*

The advantages of a built-in automatic system are particularly obvious in solving this problem. The machine does not have to be shut down for an oiler

to get at the bearings, and the possibility of the oiler being injured or burned in the process of lubrication is eliminated. Use of stabilized oils, preferably with low carbon residue characteristics, or stabilized greases are further aids in solving this problem.

5. *Bad housekeeping conditions and fire hazards.*

The manner in which sealed centralized systems eliminate the problem of oil drippage which can be a serious and costly "house-keeping" problem has already been discussed. But when it comes to helping prevent fires these systems are of even greater importance. Insurance statistics reveal that textile mills average four fires a year while all other classes of risks have 1.3 fires a year. One of the three prime reasons for fires in textile mills, and particularly those processing cotton, is friction, caused by poor machine lubrication, the misalignment of moving parts, and chokes wherein fibres jam between moving parts, creating heat.

With automatic, time controlled lubrication systems these factors causing excessive and dangerous degrees of friction are eliminated, as all bearings are running cool with a constant film of refinery pure lubricant.

6. *Stocking too many types and kinds of lubricants.*

Centralized systems have been most instrumental not only in helping to reduce the necessity for stocking a large number of types and kinds of lubricants, but also in the quantity of lubricants used per machine. Two factors are primarily responsible for achieving these benefits: (1) positive control at all times over the operation of the entire system and (2) control over the exact quantity needed to maintain a constant lubricating film at all times on all bearings. Due to time-clock controlled lubrication at predetermined frequency, one type of lubricant in place of four or five can be used on all machine bearings, and there is no waste or over-lubrication as encountered with hand-operated grease guns and oilers. It is a documented fact that mill after mill has cut lubricant consumption up to 50 percent.

7. *Excessive power consumption.*

Inadequate and improper lubrication always results in excessive friction and drag on moving machine parts requiring more and more power-drain to operate the equipment. By installing automatic power lubrication, mills have recorded savings in power consumption up to 20 percent.

8. *High compensation costs resulting from accidents attributable to manual lubrication.*

One has only to walk through the maze of high speed, intricate machinery in the modern textile mill to realize the hazards in attempting to practice manual lubrication. A typical example is the case of an oiler who was killed when he slipped and fell while in the process of lubricating an overhead crane. The man left a family behind, and the accident resulted in an $18,000 compensation claim. This tragedy and the attendant cost could have been prevented by use of a centralized system of lubrication. Obviously, these "built-in" systems completely eliminate the dangers to maintenance personnel that stem from moving machinery and the need to climb up on the machines or on ladders to reach certain lubrication points with manually operated lubricators.

SUMMARY

The proven economic advantages of modern power lubrication systems have been well documented and there should be no one who does not acknowledge the validity of the benefits and the necessity for adopting automatic systems as a competitive "must." Some may say, however, "All of this is so obvious. Why must it be spelled-out!" Calvin Coolidge once remarked—"The obvious often needs re-stating." Reference is made to a recent article in a leading textile publication which said that a particular textile mill was making a special effort to hire exceptionally tall maintenance men to better contact hard-to-reach bearings without using a ladder.

Everyone knows that mill managers are trying harder than ever before to reduce operating costs. And top management is at last going beyond work simplification plans, cutting down overtime and laying off personnel. Management is taking a long hard look at its growing investment in production facilities and is seriously searching for and insisting on more effective methods to protect and increase dividends from this investment in terms of lower costs and greater productivity.

The squeeze between costs and prices makes it imperative that workable ways be found now, not next year, to preserve profit margins. Management has discovered a "gold mine" in the multiple benefits provided by centralized power lubrication systems. It only remains for a greater proportion of the textile industry and Industry in general to take advantage of the proven benefits assured by these systems.

In the final analysis, industry must disassociate lubrication from maintenance. This is the basic approach to acquiring the benefits made available through modern lubricant application systems. Maintenance is an intermittent operating function the need for which is indeterminable and its occurrence unpredictable. Lubrication is a continuing operating function. Its need is imperative; its occurrence can be predetermined; and its planning is, therefore, simple and positive.

Centralized Lubrication in Production Foundries

Walter Kloc

Chevrolet-Tonawanda Foundry
Buffalo 7, New York

Fig. 1. Typical lubrication installation showing conditions under which proper lubrication must be maintained.

Four years ago when the author's company's foundry was in the process of construction, lubrication of industrial equipment had received a good share of consideration. Many of the lubrication points on the industrial equipment were so spread in latitude and elevation that it was impossible for an oiler to lubricate these points with safety.

A planned lubrication program was instituted. Surveys were made of the complete plant lubrication requirements. The analysis of the survey was completed as to the method, type and frequency of lubrication required by the industrial equipment. It was evident that a number of lubrication points would have to be connected by piping and that platforms, catwalks and ladders would have to be installed. Since time and cost was an important factor to get the foundry in operation, the problem was resolved in the following manner: Where excessive piping to lubrication points was necessary or where there was a concentration of lubrication points in a small area, centralized lubrication systems were installed. Where ladders, catwalks and platforms were installed for the proper inspection and maintenance of industrial equipment, tote-a-hose power lubrication systems were installed in such a manner that these systems could be converted to automatic lubrication systems if desired in the future.

Today in the foundry there are many lubrication systems. Six different manufacturers of centralized lubrication equipment and numerous methods of lubricant application are represented. A few examples of the different lubrication systems used in the plant are described and their performance will be discussed.

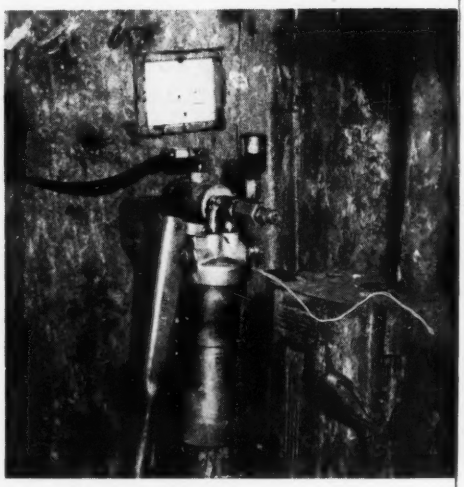
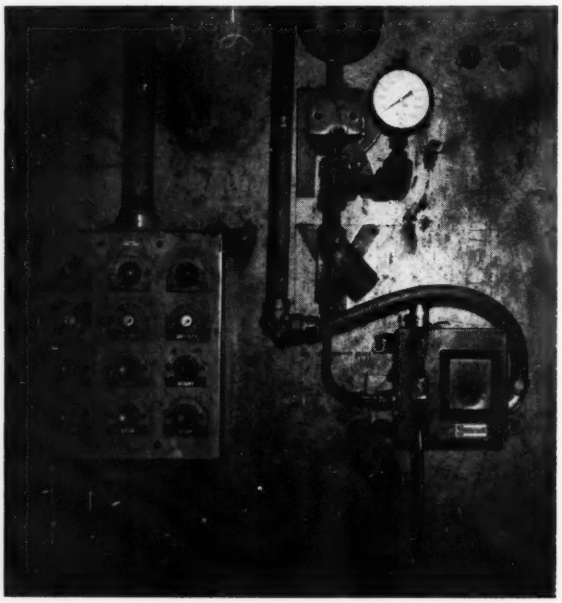


Fig. 2. Manually operated lubrication system on hot metal crane.

Fig. 3. Automatic lubrication interlocked with machine.



INSTALLATIONS

One complete centralized lubrication system services nine vertical ovens, which are of a similar size

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and construction. The ovens range in height from 60 to 80 feet, which would require an oiler to climb approximately 52 feet up and down each oven. Forty hours per month were required by an oiler to cover all the lubricant points under individual lubrication. About four hours a month is now required for inspection of the centralized system and for maintaining lubricant in the pump reservoir. This system has a single line distribution of lubricant. Approximately 900 ft of piping and 300 ft of tubing are contained in the system. Some of the lubricating points are 340 ft from the lubricant pump. In addition, this system can be used as a tote-a-hose power lubrication system by turning a selector switch. Bearings located in the surrounding area, such as idler rollers of belt conveyors and overhead conveyors which do not require frequent lubrication, can be served with simplicity.

There has been no bearing failure or maintenance requirement outside of a periodic inspection of bearings and supplying the pump with lubricant.

In one of the departments, an area 120 x 280 ft, there are two automatic centralized systems. One system services over 190 air-operated equipment and tools, such as: air hoist, air-operated wrenches, chipping hammers, and air grinder wheels. A large lubricator was installed in the main air line feeder supplying this area. Oil is atomized into the dehumidified air passing through. The performance of this centralized lubricator is highly satisfactory. One can readily see what a tremendous saving this centralized lubricator has over individual lubricators for each air-operated equipment or tool.

The other automatic centralized system in this department services the various lubrication points on the industrial equipment such as shot blasting machines, grinding machines, belt conveyors, etc. Originally some of this industrial equipment was purchased with individual automatic centralized lubrication equipment of different manufacture. All this industrial equipment is now consolidated to be serviced by a single lubricant line, one cycle timer and one pump. Machines, which do not operate daily, have a lubricant admitting valve that operates only when the machine is in operation. An additional feature these machines have is an inexpensive counter to record the number of lubrication cycles. When the industrial equipment was consolidated to be serviced by one centralized lubrication system, only the extra cycle timers and pumps were removed. The lubricating devices for each lubricant point on each machine remained intact.

One of the four similar automatic centralized systems services 18 units of industrial equipment which are interlocked to operate simultaneously, similar to a large automation system. This system contains about 800 ft of piping and over 300 ft of tubing. Some lubricant points are over 300 ft from the lubricant pump.

All centralized lubricating systems have counters. On large centralized systems, counters are installed at the pump—and at the extreme end of a lubricant line. The counters are adapted to operate from 2000 psi or over at the pump installation and 1200 psi or over at the end of the line installation. These counters are so adapted to show a complete count only; for example, if the line pressure at the end of the line reached 1200 psi or over. Then at the end of the pumping cycle, the line pressure must drop below 400 psi before the lubrication cycle is repeated.

The counters are relatively inexpensive and may be adapted to operate at a different pressure and on different centralized systems. They supply a good record on centralized lubrication and also serve as a positive check on the proper function of cycling timers, as a malfunction of a cycling timer may go undetected for some time.

The counter installed at the end of a lubricant line in a centralized system will denote any changes in the lubricant. A good example of how a lubricant can cause failure of a centralized lubrication system appeared about a year ago. One of the lubricants used in a centralized system, after three years of operation, developed a differential pressure of 1500 psi between the pump and the end of the line pressure. The end of the line pressure did not drop below 600 psi before the next cycling time. An intensive study was made. It was discovered that the same lubricant would congeal from NLGI Grade #1 to about NLGI Grade #3 after one month in storage. The vendor of the lubricant made his study of the problem and determined that a new jelling agent used in the manufacturing of the lubricant was the culprit. The vendor exchanged the lubricant and the lines were purged. Now the system functions in a normal manner.

About 80 percent of the overhead conveyors in the foundry have automatic lubricators. On two overhead conveyors that travel a considerable length of time in a high temperature core baking oven, an automatic mist spray on the conveyor trolley wheels and chain proved to be a solution to what was an extensive maintenance and lubrication problem. Four hours a day were spent lubricating the conveyors. The maintenance on replacing frozen bearings in trolley wheels on the conveyors was immense. About six hours a month is spent now in maintaining lubricant in the automatic lubricator. The maintenance cost on these two conveyors, over a four year period, is lowest of any conveyor in the entire plant.

On one type of industrial equipment, equipped with a centralized system, there were a number of bearing failures for lack of lubrication. The centralized system was removed and the lubrication of the industrial equipment was done by individual point lubrication. The bearing failure continued. After investigation of the problem, it was discovered the industrial equipment was so designed that the lubricant could not pass into the bearing for proper lubrication.

(*Cont. on p. 79*)

Evaluation of Fluids by Hydraulic Pump Tests

William M. Schrey

Field Lubrication Engineer
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Hydraulic oil is an oil especially suited for use as a power transmission medium in hydraulically operated equipment. In the most complex of hydraulic systems this basic principle of power transfer can be seen readily. Since this transfer of power or pressure from one location to another is the purpose of hydraulic fluids, it would seem logical to assume that the power transmittal qualities of a hydraulic fluid are of primary importance. However, contrary to logic, many frequently put the cart before the horse by spending innumerable hours in the laboratory determining various qualities of a fluid without a thought to the fundamental quality of power transmission.

Since hydraulic fluids are used to transmit pressure or power, it follows they should be tested by transmitting pressure or power . . . as in a hydraulic pump test. Pump tests are the logical answer to the testing of the fundamental qualities of a hydraulic fluid.

METHODS OF TESTING

In the past few years considerable disagreement has developed as to the most useful and practical methods of evaluating hydraulic fluids. By association with hydraulics, many persons in varied professions are drawn into the discussion. It would be wise to differentiate at the start between the two groups in order to better understand the goals of each. The first group consists of those who are held responsible only for the reporting of test numbers on a laboratory testing basis. In the second group are those who must go beyond the test and actually evaluate the test results into a specific recommendation for use. Many are directly or indirectly engaged in this latter phase of testing, where a decision must be made regarding the use of a fluid.

Any hydraulic fluid, whether it be fire resistant or conventional, must operate satisfactorily in hydraulic systems. Generally speaking, the basic design of all hydraulic equipment is uniform, and to change the equipment to fit the fluid is the exception rather than the rule. A good hydraulic fluid must have four important qualities; i.e., viscosity, lubricity, corrosion resistance, and stability. Viscosity (or flowabilty) is naturally of prime importance. If a fluid is too viscous, it cannot be pumped; likewise, if it is too thin slippage is encountered as is loss of both pressure and gallonage in vane type pumps. Lubricity is the ability of the fluid to oil or lubricate the moving parts of the equipment to prevent wear. Corrosion resistance is the ability of the fluid to resist all types of corrosion, and stability is the quality of the fluid to remain mechanically and chemically the same over prolonged periods of use.

The development of laboratory lubricating property tests for evaluating all types of hydraulic fluids can be outlined conveniently in two main categories. First, the laboratory bench tests measure the wear and load carrying characteristics of the material being tested. Second, the simulated field service tests or pump tests measure not only the properties of wear and load carrying, but also serve as an instrument in evaluating oxidation characteristics. Oxidation characteristics would encompass viscosity increase of the fluid, development of acid constituents, sludging, rusting of the pump and system parts, and color.

At present there are three means available for the testing and evaluating of hydraulic fluids:

1. Field testing under actual operating conditions.
2. Laboratory testing using standard bench and chemical tests.
3. Laboratory testing combining standard bench and chemical tests with simulated pump tests.

The first—actual field testing—though the best by far, is impractical in most instances. Many of the conditions encountered in actual operation of hydraulic equipment make field testing a limited source of information. The second—laboratory bench and chemical tests—would include the following: Viscosity, Neutralization Number, Viscosity Index, Conradsen Carbon, Pour Point, Oxidation, Anti-rusting, Anti-foaming, Shell 4-Ball, Shell Wear, Falex Almen, and the Timken Tests. It is possible to determine with these tests a great deal regarding the makeup and characteristics of a fluid, but there is still the question: "Will it operate satisfactorily over long periods

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of time under high pressure in a particular hydraulic system?" This necessitates the third means of evaluation—the combination of standard laboratory tests with hydraulic pump test units. In general it might be said that the standard laboratory tests will tell what a certain fluid is, and the pump test will tell what it will do.

PUMP TEST METHOD

Hydraulic pump test units have been used for a number of years, by various oil laboratories, to evaluate hydraulic fluids. Their widespread use in recent years is partially attributable to the sudden swing to fire resistant fluids and the problems encountered in their use. Before describing the pump test and the data obtained by its use, it would be well to point out that since there is no actual standardization of pump test units, the stated pressures, temperatures, etc., in this article will refer to one unit only. Many other laboratories operate units differently to better suit their specific needs.

In the evaluation of hydraulic fluids over the past four years, the Shell 4-Ball Wear Tester has been used as a laboratory bench test in conjunction with a simulated field service test—the Vickers Vane 104E Pump Test. An attempt is being made to correlate the wear data recorded by the Shell 4-Ball Wear machine with that obtained by the pump test. The Shell Wear Test is run at 1800 rpm, at a temperature of 130F, with a 7.5 kilogram loading. Duration of the test is one hour.

The pump test is a small compact system with a 3-½ gallon capacity welded steel reservoir and a water jacket operated automatically by a control arrangement which effectively controls the selected test temperature. There is no work load and a constant pressure of 1000 psi is maintained. The complete gallonage is returned to tank over the relief valve and a meter is used for measuring the total gallonage. A two horse power motor runs the pump at 1120 rpm. A 50 mesh stainless steel strainer, full flow just before inlet into pump, filters the fluid. The pump is a Vickers Vane 104E with a rated capacity of 1.9 gallons per minute at 1000 psi at a temperature of 120F. Operating temperatures in the main have been 175F for all petroleum oil fluids and non aequeous synthetics, and 150F for aequeous solutions and emulsions. The choice of these two temperatures, which admittedly are high for most operations, was made in order to accelerate the test. The test runs for 1000 hours unless loss of pressure, pump chatter, or fluid breakdown signifies an earlier end.

Before assembly of a new pump, each vane is tested in all the rotor slots for freedom of movement. Each part is minutely inspected for any type of flaw. Each part is weighed separately to a thousandth of a gram. From experience it has been found necessary to check the face of each bushing for high or low spots. This is done by rubbing the face of the bushing with

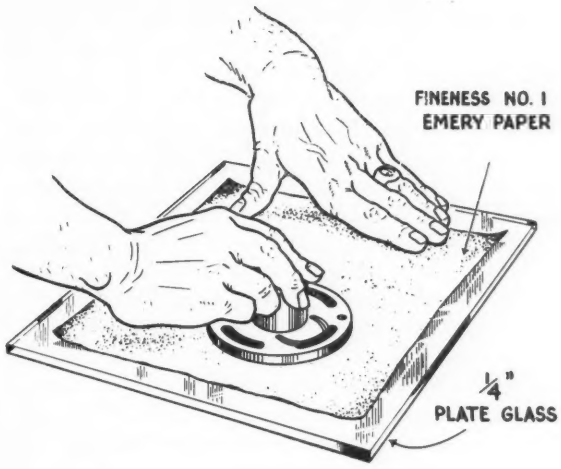

Fig. 1. Method of making bushing adjustment.

#1 fineness emery paper on a flat plate glass. If the irregularities are minor, an attempt is made to perfect the face by rubbing the bushing slowly and evenly over the emery paper. If the bushing is concave or convex, it is discarded (Figure 1). If it is impossible to obtain the rated pumping capacity of 1.9 gpm during the first hours of the test, a new pump is installed for the test. Constant pressure of 1000 pounds is maintained throughout the test. However, a test has been run on an intermittent basis. With intermittent cams operating the "start-stop" switch, it was possible to set up a cycle of 20 seconds on and 20 seconds off with the relief valve locked at 1000 psi. This set up a constant shock load running from zero pressure to 1000 psi every 20 seconds. A total of 5000 starts and stops was made with no apparent damage to the running parts.

Figure 2 illustrates pump jigs used for easy extraction of pump parts when they become wedged in the housing.

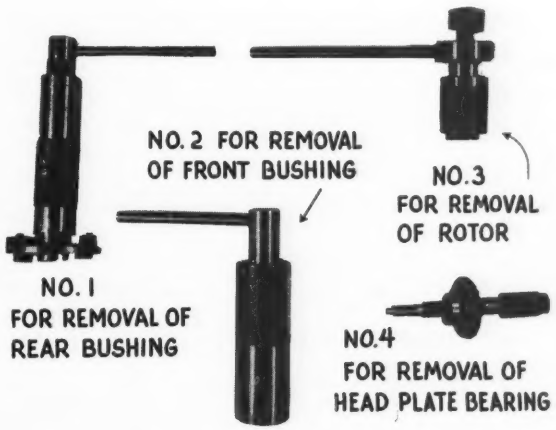

Fig. 2. Jigs for Model 104-E Vickers pump.

A great advantage of the simulated service test or pump test lies in checking the deterioration of the fluid itself along with wear indications on the pump. Tests for increase in viscosity at the operating temperature, neutralization number, precipitation number, and color are made at 250, 500, 700, 775, 850, 925, and 1000 hour stages of the test. The wear indication on the pump parts is made only at the conclusion of the test although some laboratories check weight losses at various times throughout the run. Table I contains data on sixteen 1000-hour pump tests. The tabulation shows the characteristics of five classes of fluids; namely, straight mineral oils, additive type oils, synthetics, water glycols, and inverted or "water in oil" emulsions. These data, though only a part of the complete results on the pump tests, do show the wide variations in the different type fluids.

EVALUATION OF PUMP TEST DATA

As shown in Table 1 of the 16 samples tested, there were two (both straight mineral oils) that failed before the 1000 hours were completed. Sample No. 6 failed at 648 hours because of pressure loss and complete loss of flow rate. However, as shown under the corrosion column, this oil had rather good anti-rusting characteristics. In many high loss systems where the oil make-up is such that the complete gallonage is replenished in a month, this oil has been operating satisfactorily. In other words, the overall data on a pump test must be taken into consideration. Admittedly, the small differences in wear and sludging make it advisable to compare the complete results of each fluid. In the selection of a fluid the hydraulic system itself will quite often be the determining factor, as in the case of Sample No. 6. This will be especially true where the use of a fire resistant fluid is contemplated. The system itself must be thoroughly scrutinized to determine which fluid will operate to best advantage. The overall data obtained by use of the pump test is then most beneficial in the determination of which fire resistant fluid will operate to best advantage in a particular hydraulic system. Since there are no actual standards for pump tests, the relative merit of one fluid vs. another fluid can be judged only after a comparison is made of all the data obtained during a test run. Although the test apparatus contains the same type pump as used in the field, the assembling of correlation data is a long time-consuming process and until sufficient information is available to make specific recommendations, it is necessary to use comparative data obtained from the pump test.

The suggestion for a 500-hour run has been made under 1000 psi loadings. This could possibly be done by studying wear rates on pump parts at 100-hour intervals. There is some feeling that the majority of wear characteristics occur in the first few hundred hours of operation. Although this might show a good wear loss indication, what then happens to the desire for studying the chemical breakdown characteristics of the fluid? A check of analyses of fluids run on the pump test shows little breakdown of the fluid at the 500-hour stage.

PRACTICAL USE OF PUMP TESTS

A recent problem has been the testing of an inverted emulsion for possible use as a fire resistant fluid in mining operations. In cooperation with Samuel P. Polack of the United States Bureau of Mines, tests were conducted on a particular fluid (including pump wear tests) to determine its suitability for mine hydraulic operations. This fluid, a 50/50 emulsion, is the type mixed by the consumer. A 1700 rpm hand

TABLE 1. HYDRAULIC PUMP TEST DATA ON SIXTEEN SAMPLES (All tests were of 1000 hours duration unless noted otherwise.)

	NEUTRALIZATION NO.				SHELL 4-BALL WEAR	
	BEFORE	AFTER	WEIGHT SLUDGE	% WEAR	BEFORE	AFTER
STRAIGHT MINERAL OILS						
1.	0.014	2.173	36.05 Grams	.41%	.47 mm	.38 mm
2.	0.028	1.290	17.49 Grams	.42%	.50 mm	.63 mm
3.	0.073	0.915	12.20 Grams	.28%	.65 mm	.49 mm
4. (454 Hrs.)	0.075	0.860	2.42 Grams	.16%	.34 mm	.65 mm
5.	0.392	2.044	5.69 Grams	.13%	.36 mm	.35 mm
6. (648 Hrs.)	0.028	1.320	16.06 Grams	.83%	.43 mm	.39 mm
MINERAL OIL WITH ADDITIVES						
1.	0.220	0.334	24.35 Grams	.008%	.20 mm	.26 mm
2.	0.390	1.260	3.69 Grams	.004%	.25 mm	.21 mm
3.	1.710	2.072	24.40 Grams	.079%	.26 mm	.25 mm
NON AEQUEOUS SYNTHETICS						
1.	0.056	0.200	Nil	.023%	.52 mm	.54 mm
2.	0.030	0.114	1.210 Grams	.006%	.30 mm	.34 mm
WATER BASE FLUIDS						
1.	1.40	1.40	4.015 Grams	.028%	.40 mm	.58 mm
2.	1.43	1.25	1.688 Grams	.012%	.54 mm	.54 mm
3.	2.80	1.12	0.371 Grams	.019%	.45 mm	.51 mm
INVERTED EMULSIONS						
1.	0.180	0.200	0.728 Grams	.142%	.42 mm	.35 mm
2.	0.602	3.302	0.725 Grams	.076%	.68 mm	.40 mm

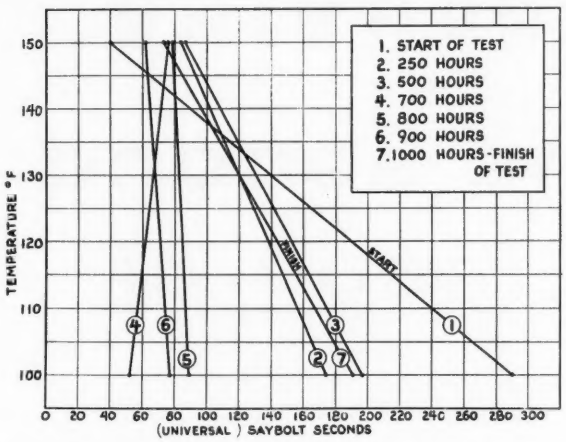

Fig. 3. Variations of viscosity of emulsion during pump test.

mixer was used to emulsify the oil and water. It is important in this procedure to add the water to the oil slowly. Once the emulsion was formed, it was quite easy (after separation) to reform the emulsion. Distilled water was used for the pump test, and tap water was used for several other tests. In both instances the results correlated and the fluid is now on a trial run in a mine. The sudden drop in viscosity at the start of the test is attributed to the better emulsion formation by the pump action as compared to the electric hand stirrer. (See Figure 3) The high leakage rate with mining machinery was responsible for the quest for a low cost emulsion as a fire resistant fluid.

An example of the practical application of hydraulic pump tests can be seen in the testing and eventual mill use of synthetic type seal fittings. As an experiment, tests were conducted of these fittings on the hydraulic pump test. The results were so favorable they were recommended for use in the mills. To date several mills have reported exceptional savings in cutting down leakage rates on hydraulic machinery by the use of these seals.

ADVANTAGES OF PUMP TESTS

The pump test unit has been considered of such importance that a second unit which will handle pumps of 2000 psi rating has been acquired. In addition to the higher pressure, the unit has several features which will add greatly to the versatility of testing. These features will include:

1. An adjustable pump base to accommodate any type pump. (Already contemplated are five different pumps; namely, two vane type, two gear type, and one radial piston.)
2. Three separate cooling devices for more accurate temperature control.
3. Entire unit is designated for easy removal of all components for cleaning purposes.
4. Base of ½ inch steel plate with provisions for floor bolting to lessen vibration.
5. Provisions for modifying unit to simulate specific operations.

The many advantages gained with a simulated field pump test (in addition to actual breakdown or failure of the fluid) would include:

1. Actual determination of wear under pressure.
2. Actual determination of breakdown of fluid under use.
3. Effect of fluid on packings and seals.
4. Viscosity change under use.
5. Effect of the fluid on hydraulic components.
6. Determination of fluids resistance to vapor state corrosion.
7. Available variations in operating conditions to simulate specific problems.
8. Sludging characteristics of fluids.
9. Effects of fluid on filiters.
10. Determination of non-leakage qualities of the fluid.
11. Stability of emulsions under flow and pressure.
12. Rate of water loss under operating temperatures.
13. Viscosity change with loss of water.
14. Determination of heat transfer qualities of the oil.

These advantages would be difficult to duplicate in other tests excepting actual field testing. With additional pump stands being installed by various companies, in both oil and other industries, the advantages listed will undoubtedly be multiplied by experience of the users and the exchange of ideas and theories on their practical use.

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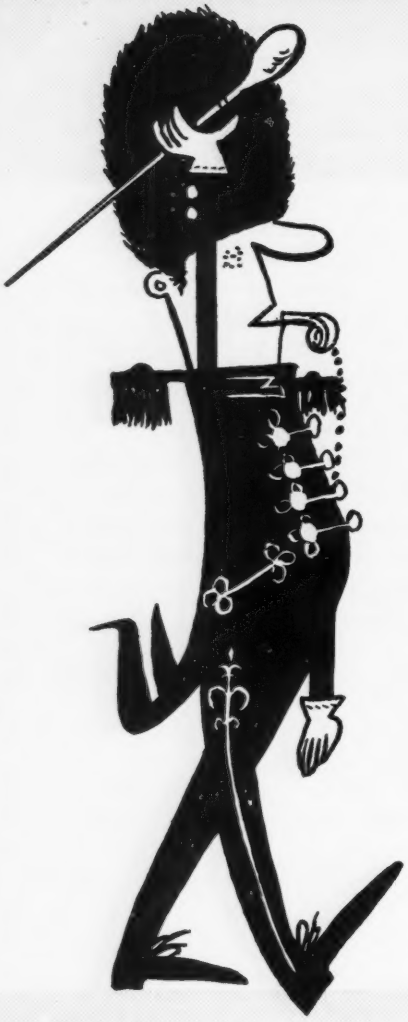

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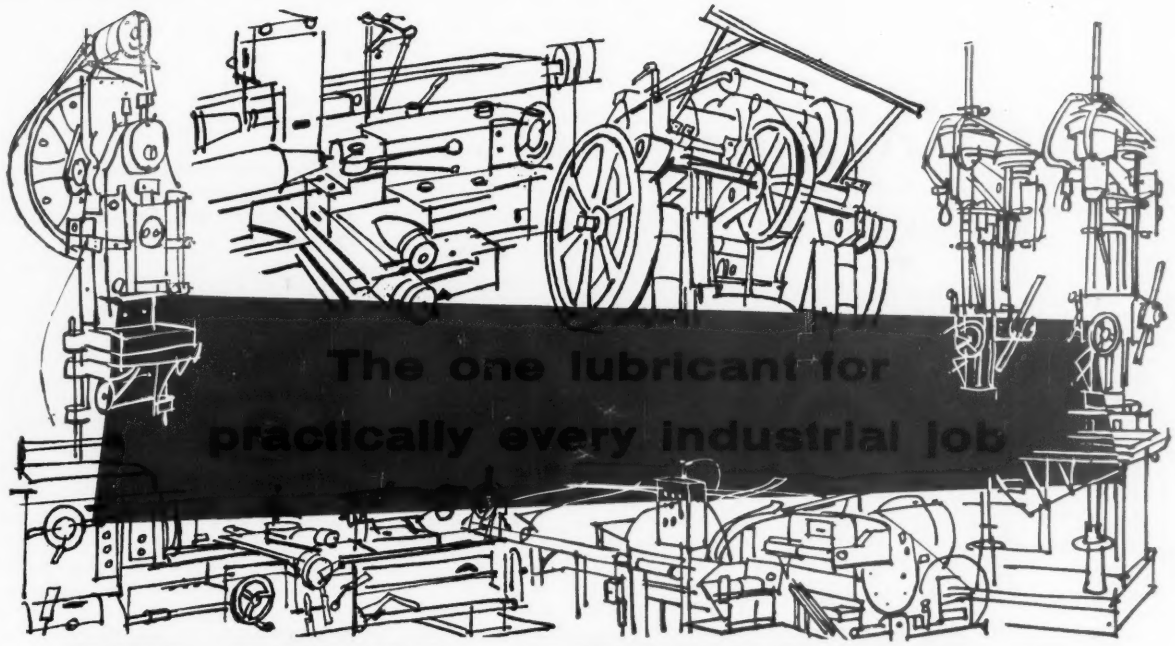

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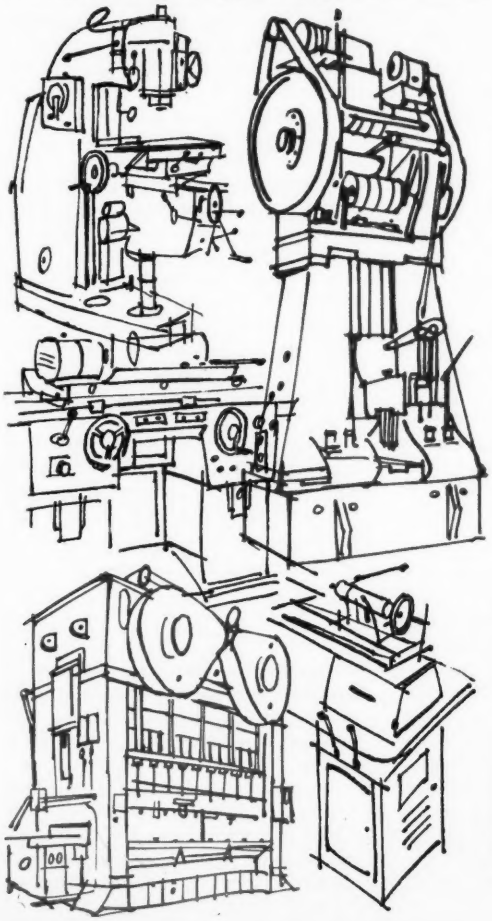

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Lubrication Abstracts

Edited by W. E. Campbell

Selected literature compiled by members of the Technical Committees and Industry Councils of the Society.

"The Oil Film in Sintered Bearings," R. A. Arnold and H. Ruel, Schmiertech., v. 4, No. 3, 1957, IV-V.

Determination of the oil film thickness in sintered bearings by oscillographic measurement of AC breakdown voltage is described and held to be more reliable than the DC method using a glow discharge lamp. A sintered bearing testing machine with shaft diameter of eight mm. is used, 50 cycles per second voltage of about three volts is supplied, and the bearing's behavior recorded on the oscillograph. A linear relationship between load and breakdown voltage is found. A more viscous oil carries a higher load than a thinner oil. The dependence of oil film breakdown on temperature is confirmed. Starting tests show that the oil film is formed faster on the sintered bearing than on the solid bearing. (*Abstracted by E. O. Forster*)

"Phenomena Associated with the Debris Formed in a Meter-type Bearing with Various Combinations of Materials and under Different Conditions of Speed and Loading, with Special Reference to Tungsten," G. F. Shotter, The British Electrical and Allied Industries Research Association Technical Report, T/T49, 1956.

This report describes and gives the results of twenty-nine tests conducted to determine the cause of variations in the type of debris produced in a meter-type bearing combination of sapphire-tungsten and diamond-tungsten. The variables studied and reported on here are: types of tungsten, optical axes of sapphire, facets of a tungsten crystal, speed and load conditions. Two types of debris were in general produced. In the case of the sapphire-tungsten combinations, with one exception, a high friction, highly abrasive, black color debris was formed. On the other hand, the diamond-tungsten combinations resulted, with one exception, in the formation of a low friction, yellow colored debris. The only two variables that appeared to affect the type of debris formed were speed and load. The single exception noted with the sapphire-tungsten combination is a test conducted on lubricated bearing surfaces at low speed. The debris formed in this case is, in all respects, similar to that formed with the diamond-tungsten combinations. In this case it is postulated that the temperature of the contact surfaces of the bearing is not sufficient, because of the low speed and lubricated surfaces, to form the black colored, high friction debris generally associated with the sapphire-tungsten combinations. The single exception noted in the diamond-tungsten combinations in which black debris was produced is a test conducted at a very high speed. In consequence this is attributed to the high frictional heat resulting from the high speed. The sapphire-tungsten combinations are found to have a coefficient of friction of about three times that of the diamond-tungsten combinations. The conclusion drawn is that the type of debris (tungsten-oxides) formed is largely a function of the temperature of the contacting surfaces of the bearing. (*Abstracted by James I. Clower*)

"An Immersion Viscometer," F. D. Penny and G. C. Ackroyd (Dept. of Scient. and Ind. Research, Fuels Res. Sec.), Petroleum, v. 21, no. 6, 1958, pp. 196-9.

A viscometer of the rotating cylinder type is described that can be immersed to any desired depth in tanks containing viscous fluids. The instrument is designed to operate at constant shearing stress within the range of 50 to 1000 dynes/cm^2 with shear rates varying between 0.1 and 6 sec.$^{-1}$ using torsion wires of various stiffness. (*Abstracted by E. O. Forster*)

"Influence of Some Additions on the Thickness of Lubricating Films," A. Dievichs, Schmiertech, v. 5, March/April, 1958, pp. 63-9.

EP additives reduce the oil film thickness of pure oils compressed between metal plates. The oil film thickness is measured interferometrically for pure mineral oils, vegetable oils, and oils with additions of thiophosphoric acid esters of C_7-C_9 *n*-alcohols, T.C.P. and phosphoric acid ester of C_7-C_9 *n*-alcohols. The reduction of oil film thickness by EP additives is believed due to a chemical interaction between the additive and the metal surface. (*Abstracted by E. H. Okrent*)

"Radiolysis and Radiolytic Oxidation of Lubricants," by R. O. Bolt (California Research Corp., Richmond, Cal.) and J. G. Carroll. Ind. & Eng. Chem., v 50, n. 2, 1958, pp 221-8.

Comprehensive data are given to show the relative stability of various types of fluids exposed to pile and gamma radiation. Aromatic materials and polypropylene ethers perform well, although the viscosity stability of the latter appears due to formation of low molecular weight products counterbalancing the normal thickening effect. Dodecyl selenide and iodine compound show promise as inhibitors. VI—improved oils give rapid losses in viscosity and V.I. as a result of additive depolymerization. Most tests are extended to about 2.5x10^{18} slow neutrons/cm^2. Dosages four times greater change even the promising fluids to solids. (*Abstracted by M. I. Smith*)

"The Performance of Zinc Dithiophosphates as Lubricating Oil Additives" by R. Larson (American Cyanamid). Scientific Lubrication, v 10, n. 8, 1958, pp 12-19.

The mechanisms whereby zinc dithiophosphates function as anti-oxidants, bearing corrosion inhibitors, and anti-wear agents are discussed. As an anti-oxidant, the additive acts by decomposing peroxides. In doing so, there is formed a largely inorganic residue which deposits a protective film on bearings. Variations in the alkyl components of the additive may give rise to wide differences in performance, and data are presented to illustrate this. (*Abstracted by M. I. Smith*)

"Preparation of Lubricating Oil Additives from Dimercaptothiadiazole," by E. K. Fields (Standard Oil Co. of Indiana, Whiting, Ind.), Industrial & Eng. Chem., v 49, n. 9, 1957, pp 1361-4.

Preparation of five classes of oil-soluble compounds is described. Corrosion test results on copper-lead and silver bearings indicate that some of these compounds are good corrosion inhibitors. (*Abstracted by M. I. Smith*)

"New Viewpoints in Watch Oil Research," by Tillwich, Zeit. fur Instrumentenkunde, v 65, n. 4, 1957, pp 73-7.
Desirable properties of watch oils are reviewed, and methods of measurement described. Stability is evaluated in an oxidation-corrosion test at 95°C. Lubricity is observed in a pendulum apparatus. Spreading rate on solids is measured at 80°C., and evaporation loss at 105°C. over a 16-hour period. Tests with watches at low temperatures are described. (*Abstracted by M. I. Smith*)

"Performance Assessment of Oils," by T. G. Bold and P. W. Harrison, Automobile Engineer, v 47, n. 9, 1957, pp 366-69.
Rating of piston deposits and lacquer by means of a photographic technique is described. Reflex paper is taped against the piston which is rotated in the midst of four floodlights. A screen grid is superimposed on the paper, and standard density wedges are used to compensate for differences in exposure and paper sensitivity. Demerit ratings are applied to the developed strip. As compared with conventional photographs, this method is claimed to be more rapid and precise, and does not require a trained photographer. (*Abstracted by M. I. Smith*)

"Rheological Problems of Lubrication," K. Kirschke, Chem. Ing. Tech., v. 29, 1957, p. 746.
The viscosities of several pure mineral oils are compared to those of mineral oils containing 3-15 per cent Oppanol B 50 VI improver in Umstaetter's free-flow and structural viscometers and in a four-ball lubricating oil tester. Although at small shear velocities the oils with additives have higher viscosity than the base oils, they show smaller rotational moments, friction coefficients, and heat production in the four-ball machine. The effective viscosities calculated from the three methods agree well. (*Abstracted by E. O. Forster*)

ANNUAL MEETING PROGRAM

(Cont. from p. 51)

3. "A Field Study of Gas Engine Lubricants II."
C. M. Floyd, Humble Oil & Refining Co., Baytown, Texas.

SESSION 5A 2:00 p.m. BEARINGS AND BEARING LUBRICACATION—ROLLING CONTACT

Howard Kaufman, Westinghouse Research Laboratories, Pittsburgh, Pa., Organizing and Session Chairman.

1. "Determination and Correlation of Fundamental Instrument Bearing Parameters, Including a Description of the Unique Instrumentation Used."
T. P. Barnard, Miniature Precision Bearings, Keene, N. H.
2. "A Brief Examination of Factors Affecting Tractive Friction Coefficients of Spheres Rolling on Flat Plates."
W. S. Rouverol, University of California, Berkeley; R. I. Tanner, Manchester University, England.
3. "The Behavior of Lubricated Ball Bearings in Controlled Atmospheres."
W. A. Glaeser, Battelle Memorial Institute, Columbus, Ohio.

SESSION 5B LUBRICATION EQUIPMENT

J. Philip Wettach, Dravo Corporation, Pittsburgh, Pa., Organizing and Session Chairman.

1. "Lubrication Problems in the Cement Industry."
E. F. Harchelroad, Universal Atlas Cement Division, U. S. Steel, Pittsburgh, Pa.
2. Film by Caterpillar Tractor Co.

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☐ 58LC2. "The Effects of High Energy Ionizing Radiation on Turbine Oil Performance Characteristics," by C. F. Kotteamp, R. P. Nejack, and R. T. Kern

☐ 58LC-3. "Visco-Elastic Behavior of Greases," by E. O. Forster and J. J. Kolfenbach

☐ 58LC-4. "An Analytical Study of the Effect of Offset Loads on the Performance of an 120° Partial Journal Bearing," by A. A. Raimondi

☐ 58LC-5. "Development of Seals for Rocket-Engine Turbopumps," by J. E. Wolf and R. E. Connelly

☐ 58LC-6. "A Study of Design Criteria for Oscillating Plain Bearings," by W. A. Glaeser and C. M. Allen

☐ 58LC-7. "Adhesion Between Metals and Its Effect on Fixed and Sliding Electrical Contacts," by W. P. Mason

☐ 58LC-8. "Transition Temperatures in Sliding Systems," by R. S. Fein, C. N. Rowe, and K. L. Kreuz

☐ 58LC-9. "Wear and Friction of Filled Polytetrafluoroethylene Compositions in Liquid Nitrogen," by D. W. Wisander, C. E. Maley, and R. L. Johnson

☐ 58LC-10. "The Conduction of Current in Bearings," by H. N. Kaufman and J. Boyd

☐ 58LC-11. "A Surface Effect Associated with the Use of Zinc Dialkyl-Dithiophosphate-Treated Oils," by P. A. Bennett

☐ 58LC-12. "Film Formation by an Anti-Wear Additive in an Automotive Engine," by M. J. Furey

☐ 58LC-13. "Testing and Operation of Ball Bearings Submerged in Liquefied Gases," by K. B. Martin and R. B. Jacobs

☐ 58LC-14. "Effect of Fibre Orientation, Temperature and Dry Powder Lubricants on Rolling Contact Fatigue," by W. J. Anderson and T. L. Carter

☐ 58LC-15. "Rolling Contact Fatigue Evaluation of Bearing Materials and Lubricants," by E. G. Jackson

☐ 58LC-16. "Materials in Rolling Element Bearings for Normal and Elevated (450°F) Temperatures," by T. W. Morrison, H. O. Walp, and R. P. Remorenko

ASLE Technical Digest

Papers which, because of space limitations, cannot be published in full in Lubrication Engineering or ASLE Transactons.

"The WADC Deposition Test," H. R. Smith, Wright Air Development Center, Wright-Patterson AFB, Dayton, Ohio, 58 AM 2C-3.

The use of synthetic lubricants in high temperature turbojet engine service parallels the application of petroleum oils for more conventional reciprocating engines operating at lower peak temperatures. In both cases the products of thermal and/or oxidation deterioration must be studied. The nature and degree of the resultant deposits can interfere seriously with proper functioning of gears, bearings seals, filters, even to the extent of actual failure. As a result, careful consideration has been given to perfecting a screening test by which an oil can be evaluated from a deposit point of view—comparable to actual service in the engine and taking into account the several variables involved in engine deposit formation.

The WADC deposition test rig serves this purpose because it approximates engine service conditions in regard to temperature and oxidation. In application, air serves as a means of agitation in the coking head as well as a means of introducing oxygen and moisture. The coking tube in the head corresponds to hot spots in the engine, while the moist air parallels the oxidation and hydrolytic conditions which prevail in service. Recovery of sludge and oxidation products is accomplished by directing the oil flow from the head through a cooler, pump and filter, then recycling to the coking head. Sludge and coke values are determined from the differential weights of the filter screen and coking tube, before and after the test. Then a deposit rating comparable with engine service is figured by adding the sludge weight to 10 times the coke weight.

The value of the WADC deposition test as a means of screening engine lubricants as to deposit tendency indicates that it may be extended to evaluation of lubricants for other high temperature service. Also, it may be of value for the study of corrosion tendencies under engine simulated conditions or as a test for screening engine oils for degradation with respect to acid number and viscosity change. (*Digested by A. F. Brewer*)

"Test Procedures for the Sikorsky Aircraft Friction Oxidation Tester," F. W. Jones, Sikorsky Aircraft Co., Bridgeport, Conn., 58 AM 2C-2.

Lubrication has a direct relationship to friction oxidation. Actually it involves a two-fold function—(1) maintenance of a lubricating film to reduce surface damage and, (2) dispersion of the wear results or so-called debris formed by fretting between the ferrous metal parts. Research indicates that frequent changes of lubricant which remove this debris tends to prolong bearing life. Unfortunately it is not always possible to completely purge a bearing of a contaminated lubricant. In this case, the lubricant itself, often a grease, must be relied upon to be as effective as possible. This has led up to considerable study of the anti-fretting corrosion properties of prospective greases and establishment of procedural methods for their evaluation. Oscillation and loading are the basic mechanical features, primarily because fretting corrosion is most apt to occur where the amplitude of the relative motion between the contact surfaces is small. This paper deals with the tapered roller bearing tester because it allows better correlation with pre-loaded tapered bearings in helicopter main rotors. Runs are made to failure, the time to failure for the grease tested being reported in hours. Runs have been made successfully up to 250 hours. Test work to date indicates a maximum "effectivity" of grease in a bearing. In other words, time to failure appears to be proportional to the quantity of grease charged, up to a certain point; beyond that no benefit is derived from additional grease. When the most effective grease charge is determined for a particular bearing and the grease is suited to the service conditions, most dependable bearing life can be expected. On the other hand, angle and frequency of oscillation, and variations in loading also must be considered as they could contribute to the durable life of the grease. These are variables well worthy of additional investigation. (*Digested by A. F. Brewer*)

"The Application of Solid Lubricants to Turret Lathes," K. L. Davis, Jr., Warner & Swazy Co., Cleveland, Ohio, 58 AM 2A-2.

Experience with the operation of certain productive machinery mechanisms indicates that solid lubricants are most effectual in the elimination of sticking or other malfunctioning of closely fitted mating parts. Significant examples are the collet mechanism and geared scroll chuck on the modern turrent lathe. Grip and squeezing or closing effect are important functions of these mechanisms. Sticking of the collet in the hood with failure to open properly when the axial clamping force is released can reduce the output of the lathe; insufficient grip or jaw pressure in a 3-jaw geared scroll chuck could result in the workpiece coming out of the chuck during high speed machining operation.

Laboratory test studies have indicated that some form of solid lubricant such as molybdenum disulfide is well suited to the requirement that it provide and maintain a permanent coating on the frictional surfaces of the collet without effecting the runout accuracy, and with adequate scuffing off resistance. On the geared scroll chuck the same lubricant added to a conventional chuck grease reduced the internal chuck friction and enabled increased chucking jaw pressures.

Stability of the lubricating film in either case is highly important; in view of the fact that reapplication could present a problem, the durability of solid lubrication was quite apparent. Tests on pushout collets indicated marked resistance to scuff off, and reduction of fretting corrosion, although the method of application can be a factor. Baking on of the film gives best results especially where the surfaces are properly prepared by phosphating and sand blasting to enable best reaction to the adhesive qualities of the lubricant. Obviously there can be limitations to the application of solid film lubricants, but where properly applied the indication of their ability to reduce fretting corrosion is significant. (*Digested by A. F. Brewer*)

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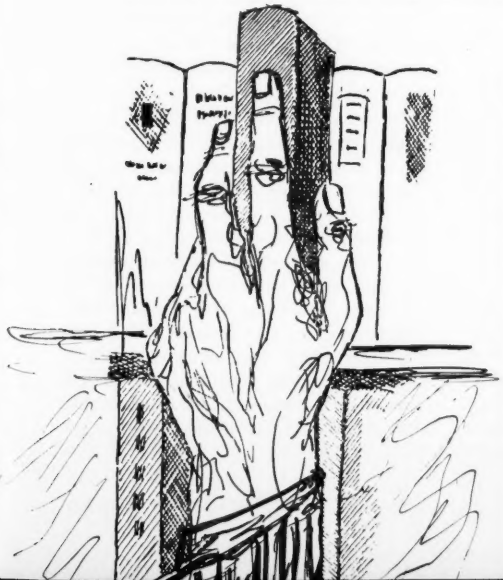

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Patent Abstracts

Compiled by Ann Burchick
Aluminum Co. of America

Lubricating Oil Composition, Patent #2,851,416 (A. R. Sabol and R. E. Karil, assignors to Standard Oil Co.) A lubricant composition comprising a major proportion of a lubricating oil and in combination therewith a minor proportion, from about 0.001 per cent to about 10 per cent by weight, of the product obtained by reacting under anhydrous conditions an olefinic hydrocarbon having a molecular weight of from about 150 to about 50,000 with from about one percent to about 50 per cent by weight of a phosphorus sulfide at a temperature of from about 200F to about 600F, reacting the phosphorus sulfide-olefinic hydrocarbon reaction product with at least about 3 parts by weight of a basic barium compound per part of phosphorus present in said phosphorus sulfide-olefinic hydrocarbon reaction product in the presence of from about 0.5 to about five parts by weight of an aliphatic alcohol per part of basic barium compound, which aliphatic alcohol has from about one to about 12 carbon atoms, at a temperature of from about 100F to a temperature not substantially greater than the foiling point of the mixture for at least about one half hour and increasing the temperature to remove said alcohol from the reaction mixture.

Lubricating Greases Thickened with 3-N-Aryl-Carbamyl-2-Hydroxy-1-Naphthyleneazoarenes, Patent #2,851,418 (J. F. Lyons and N. R. Odell, assignors to The Texas Co.) A lubricating grease consisting essentially of a lubricating oil thickened to a grease consistency with a compound selected from the class consisting of 3-*N*-aryl-carbamyl-2-hydroxy-1-naphthaleneazoarenes and substituted derivatives thereof which are free from oil-solublizing groups and from salt-forming groups.

Automatic Transmission Fluid, Patent #2,851,422 (A. Manteuffel, P. R. Chapman and G. R. Cook, assignors to The Pure Oil Co.) A high viscosity index lubricating oil composition comprising a mineral oil base and sufficient amounts of a high molecular weight polymerized ester of the acrylic acid series to impart high viscosity index characteristics to said composition, said mineral oil base comprising a major portion of a refined lubricating oil stock and a minor portion of a solvent extract obtained from the solvent refining of lubricating oil stocks to produce a lubricating oil having an improved viscosity index and increased resistance to oxidation in an amount sufficient to enhance the low temperature fluidity improving characteristics of said high molecular weight polymer as indicated by the G.M. low temperature fluidity test.

Slushing Oils Containing Copper Powder, Patent #2,852,396 (W. P. Kinneman, Jr. assignor to The Standard Oil Co.) A slushing oil for the protection of steel articles consisting essentially of 86 parts by weight of an unrefined hydrocarbon oil having a viscosity of 110 sus at 100F, 10 parts by weight of micro-crystalline wax, 1 part by weight of silica aerogel, one part by weight powdered copper metal, and two parts by weight stearic acid.

Addition of Microcrystalline Wax to Lubricating Oils to Prevent Wax Flocculation, Patent #2,852,445 (F. M. Howard and C. J. Halamka, assignors to California Research Corp.) A method of preventing flocculation in refined petroleum lubricating oils of naphthenic origin and having a viscosity above about 1200 at 100F, which comprises dissolving in the oil from about 0.02 to 1 percent by weight of a microcrystalline wax.

Treatment of Hydrocarbon Oils, Patent #2,852,454 (I. E. Puddington and A. F. Sirianni, assignors to National Research Council) A method for the continual treatment of a hydrocarbon oil to combat its continual tendency to deterioration which comprises continually recycling said oil through a treating zone in contact with fixed solid calcium and in contact with a foxed sp iod spdoi,-Pb-Sn solder alloy containing 2-15 per cent by weight of sodium, said Pb-Sn solder containing 5-95 per cent of lead and the remainder tin, said calcium and sodium-Pb-Sn solder alloy being maintained in electrical contact in said treating zone.

Steam Turbine Lubricant, Patent #2,852,465 (H. C. H. Jensen, assignor to Esso Research & Engineering Co.) In a mineral oil composition, adapted for lubrication of steam turbines, comprising a blend of a solvent extracted distillate oil, an oxidation inhibiting amount of 2,4 di *t* butyl *p* cresol, a foam inhibiting amount of hexachlorocyclo hexane, and a rust inhibiting amount of polyethylene glycol di-tri-ricinoleate, wherein the presence of said inhibitors tend to incite emulsion formation, the improvement which comprises the addition to said lubricating compound a minor proportion, sufficient to reduce the emulsifying tendency of said composition, of a sulfonated castor oil.

Grease Compositions Wherein the Thickener Comprises a Metal Salt of An N-Acylamino-organocarboxylic Acid, Patent #2,852,466 (B. W. Hotten, Assignor to California Research Corp.) A grease composition comprising a major proportion of an oil of lubricating viscosity and, in an amount sufficient to thicken said lubricating oil to the consistency of a grease, a metal salt of an *N*-acylamino-organocarboxylic acid selected from the group consisting of *N*-acylaminoarylcarboxylic acid and *N*-acylaminoalkanecarboxylic acid, wherein said metal is selected from the group consisting of groups I and II of the periodic table and wherein said acyl group is derived from a fatty acid containing eight to 22 carbon atoms, said aryl group contains from six to nine carbon atoms, and said alkane group contains from four to nine carbon atoms.

Lubricating Oil Additive, Patent #2,852,467 (W. C. Hollyday, Jr., assignor to Esso Research & Engineering Co.) A lubricating oil composition comprising a major proportion of a mineral lubricating oil and about 0.005 to 10.0 percent by weight, based on the total composition of a product in accordance with claim one.

Cutting Oil Composition, Patent #2,852,468 (E. C. Hughes and H. M. Stine, assignors to The Standard Oil Co.) A lubricating composition consisting essentially of a sulfurized mineral oil in an amount ranging from 80 to 99 per cent by weight, a partial fatty acid ester selected from the group consisting of sorbitan monooleate and sorbitan trilinoleate in an amount ranging from one to 20 percent by weight, and an oil-soluble chlorinated organic EP compound in an amount to provide from ¼ to 5 percent chlorine by weight.

Process of Preparing Lubricating Oils, Patent #2,853,427 (H. R. Bentley and M. K. Rausch, assignors to Sinclair Refining Co.) The method of producing improved non-additive aircraft engine lubricating oil stock from mixed base reduced crudes which comprises contacting a mixed base reduced crude having a viscosity of at least about 400 sus at 210F with about six to 12 volumes of liquid propane at a temperature of about 160 to 185F to obtain a deasphalted crude at a yield of about 40 to 59 volume per cent based on the charge stock, extracting the resulting deasphalted oil with about two to six volumes of phenol at a temperature of about 180 to 220F to obtain a raffinate, dewaxing the resulting raffinate, and percolating the resulting dewaxed raffinate through a neutral clay at a yield rate of about 30 to 100 barrels per ton of clay at a temperature of about 100 to 300F.

Lubricating Agents, Patent #2,853,451 (F. Fortess, C. Hohing, Jr. and C. E. Kip, assignors to Celanese Corp. of America) A lubricating composition for filamentary materials, comprising about 20 to 45 parts by weight of *n*-eicosane and about 25 to 45 parts by weight of an amine salt of an acid phosphate of a higher fatty alcohol.

Textile Lubricants, Patent #2,853,453 (M. Elton and P. A. Winsor, assignors to Shell Development Co.) An anti-static emulsifiable textile lubricant concentrate composition comprising a major amount of mineral lubricating oil and containing from about 2 per cent to about 20 per cent by weight of an oil-soluble sodium petroleum sulfonate, from about 0.5 per cent to about 10 per cent by weight of an oil-soluble partial ester of a polyhydric alcohol with a fatty acid, from about 1 per cent to about 13 per cent of 1-β-hydroxyethyl-2-heptadecylene-imidazoline and from about 1 per cent to about 10 per cent of water.

Lubricating Grease Compositions Containing Aliphatic Sulfonic Acid Soap, Patent #2,854,408 (W. H. Brugmann, Jr., J. H. Bartlett and A. J. Morway and F. Knoth, Jr., assignors to Esso Research & Engineering Co.) A lubricating grease composition comprising a major proportion of a mineral lubricating oil thickened to a grease consistency with five to 30 wt. per cent of an oil-insoluble metal soap of a substantially straight chain aliphatic sulfonic acid containing from 10 to 20 carbon atoms per molecule in the aliphatic portion thereof, said aliphatic sulfonic acid being the sole sulfonic acid present.

Method for a Calcium Soap Grease Containing a Hydrocarbon Wax, Patent #2,854,409 (H. L. Reudink, assignor to Shell Development Co.) In a process for the preparation of water-containing grease compositions having a low soap content containing calcium soaps of higher aliphatic monocarboxylic acids as the sole soap gelling agent, the step comprising comingling a pre-formed calcium soap grease and a hydrocarbon wax at a temperature above the melting point of the wax, said wax having a melting point above 50C and being present in an amount from about 25 per cent to about 67 per cent by weight of the final grease composition, said composition containing from about 0.3 per cent to about 3 per cent by weight of water, the temperature of said compositions being maintained at all times below the dropping point of the grease.

Soap-Thickened Lubricating Greases Containing An Alcohol-Substituted Amide, Patent #2,854,410 (P. G. L. Bidault, assignor to Esso Standard Societe Anonyme Francaise) A lubricating grease comprising a major proportion of a lubricating oil having a viscosity in the range of 90-1000 ssu at 37.8C and a viscosity index of 60-160, in the range of 3-30 wt. per cent of a grease-making alkali metal soap of a high molecular weight fatty acid and in the range of 0.1-5 wt. per cent of an amide.

Sulfur Containing Lubricating Oil Additives, Patent #2,854,411 (C. S. Scanley, E. E. Richardson and E. K. Fields, assignors to Standard Oil Company) A lubricating oil composition which essentially comprises a mineral lubricating oil and an oil soluble alkyl disulfide of a 1,3,5-triazine in an amount sufficient to impart to the lubricating oil improved bearing corrosion properties.

Sulfurized Additives for Lubricants, Patent #2,855,366 (A. Manteuffel and W. D. Gilson, assignors to The Pure Oil Co.) In the manufacture of a sulfur-containing sperm oil composition for use as an anti-squawk additive in a mineral oil automatic transmission fluid, said additive prepared by the reaction between sperm oil and a sulfurizing agent selected from the group consisting of elemental sulfur and sulfur chloride, the improvement which comprises carrying out the reaction for not less than about eight hours at a temperature of 340-370F by employing a reaction mixture consisting of sperm oil, an added amount of about 4-8 parts by weight of oleic acid per 100 parts by weight of said sperm oil, and a sulfurizing agent in a quantity not in excess of about 10 percent by weight, based on said reaction mixture, but sufficient to chemically incorporate 8.5-10 per cent by weight of sulfur in the product of said reaction, said additive having a viscosity not in excess of about 180 sus @ 210F.

Water Displacing Agent, Patent #2,856,299 (R. A. Westlund, Jr., assignor to Esso Research & Engineering Co.) A liquid rust preventive composition comprising about 75 to 99 parts of an oleaginous base, about 0.5 to 15 parts of a partial ester of a fatty acid having about 12 to 22 carbon atoms per molecule and an aliphatic polyhydric alcohol having about 3 to 12 carbon atoms per molecule, and about .1 to 10 per cent of a water displacing agent, said water displacing agent being the condensation product of (1) the fatty acid-polyamine reaction product of substantially equi-molar portions of a fatty acid containing about 10 to 22 carbon atoms, and a polyamine and (2) about one to 10 moles of an alkylene oxide.

Thread Sealing Compound, Patent #2,856,301 (A. S. Badger and J. Beson, assignors, by mesne assignments, to Jersey Production Research Co.) A thread sealing composition consisting of silica having a particle size consisting of equal portions of 100 to 140 mesh, of 140 to 200 mesh, and of 200 plus mesh dispersed in a viscous lubricating base, said silica being in the range of 10 to 40 per cent by volume.

Lubricating Compositions, Patent #2,856,362 (A. J. Morway, assignor to Esso Research & Engineering Co.) The method of preparing lubricating compositions which comprises dispersing an alkaline earth metal base, low molecular weight carboxylic acids having about one to three carbon atoms per molecule, high molecular weight monocarboxylic acids having from about 12 to 30 carbon atoms per molecule and an aryl sulfonic acid having six to nine carbon atoms in a lubricating oil, heating the dispersion to a temperature within the range of about 450 to 550F, and then cooling to obtain said lubricating composition, wherein the mol ratio of low molecular weight carbocylic acid to the high molecular weight monocarboxylic acid plus the sulfonic acid is about 8:1 to 20:1, the molar ratio of said sulfonic acid to said high molecular weight acid is about 1:1 to 3:1, and said metal base is present in an amount sufficient to neutralize said acids.

Stable Anti-Rust Lubricating Oil, Patent #2,856,363 (E. W. Brennan, assignor to The Pure Oil Co.) A lubricating oil composition characterized by its oxidation stability and its ability to pass the ASTM-D665 Rust Test, comprising a major amount of mineral lubricating oil, an oxidation inhibitor combination comprising about 0.35 weight per cent of ditertiary butyl paracresol, about 0.12 weight percent of a mixture of octylated and styrenated diphenyl amines, about 0.012 weight per cent of zinc dibutyldithiocarbamate, and about 0.01 to 0.5 weight per cent of an amino-alcohol.

(Cont. on p. 76)

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PATENT ABSTRACTS

(*Cont. from p. 75*)

Metal Salts of Sulfonated Acrylic Ester Polymers and Lubricating Oils Containing the Same, Patent #2,858,272 (J. F. Cook, assignor to Union Oil Co.) A lubricating oil comprising mineral lubricating oil in major amount containing between about 0.2 per cent and about 7 per cent by weight of a metal salt of a sulfonated polymerized ester.

Extreme Pressure Lubricating Grease, Patent #2,858,273 (H. J. Worth, assignor to Union Oil Co. of California) A lubricating grease comprising mineral lubricating oil thickened with five per cent to 30 per cent by weight of a calcium hydroxy fatty acid soap and containing small amounts, sufficient to impart EP, antiwear and good mechanical stability characteristics, respectively to said grease, of (1) and EP agent of the class consisting of organic compounds containing sulfur, organic compounds containing chlorine, organic compounds containing sulfur and chlorine, mixtures of said compounds and mixtures of said compounds with oil-soluble lead salts, (2) a compound selected from the class consisting of glycerine and pentaerythritol and (3) a compound selected from the class consisting of triethanolamine and triethanolamine soaps.

Thio Formal Synthetic Lubricants, Patent #2,858,274 (A. H. Matuszak and W. E. McTurk, assignors to Esso Research & Engineering Co.) A synthetic lubricating composition comprising about 90 per cent of di-2-ethyl hexyl sebacate containing combined therein about 10 per cent of a complex thioformal.

Method of Lubricating Bearings, Patent #2,859,178 (E. O. Forster and R. O. Adams, assignors to Esso Research & Engineering Co.) A method of lubricating bearings which comprises maintaining on said bearings a film of a water resistant and structurally stable lubricating grease composition comprising a lubricating oil and a grease thickening amount within the range of about 22 to 60 wt. percent, based on the total composition, of a grease thickener, said grease thickener being a metal salt of the reaction product of a high molecular weight hydrocarbon reacted with about 10 to 20 wt. percent of a phosphorus sulfide at a temperature of about 300 to 500F for about four to 15 hours, said metal being selected from the group consisting of sodium, lithium, calcium, barium, strontium, aluminum and lead.

Polyvalent Metal Mono and Dicarboxylic Acid Soap Thickened Lubricating Oil, Patent #2,859,179 (J. H. Lux and K. Parker, assignors to Witco Chemical Co.) A grease comprising a lubricating oil and a grease thickening amount of a polyvalent metal soap, said soap comprising soap molecules co-formed by reaction of polyvalent metal ions with mixed mono and polycarboxylic acids, said polycarboxylic acid in the soap is sebacic acid, the proportion of sebacic acid being from about 0.5 per cent to 25 per cent of the total carboxylic acid by weight, and the monocarboxylic acid being of the class consisting of the fatty acids containing from 8 to 22 carbon atoms.

Process for Preparing Alkali Metal-Lead Soap Base Greases, Patent #2,859,180 (T. B. Jordan, assignor to The Texas Co.) A process for preparing a mixed alkali metal-lead soap base grease which comprises forming a lead soap by reaction of lead oxide, PbO, with an excess of soap precursor in a mineral base lubricating oil at a temperature between 300 and 360F in the presence of water, cooling the reaction mixture to a temperature between 290 and 330F, forming an alkali metal soap by reacting alkali metal hydroxide in the presence of water with the unsaponified portion of said soap precursor at a temperature between 190 and 230F, said lead oxide and alkali metal hydroxide being reacted with said soap precursor in such proportions that there is formed a substantially neutral product in which said alkali metal soap and said lead soap are in a ratio of from 1:1 to 9:1, dehydrating said reaction mixture at a temperature between 300 and 450F and adding a lubricating oil to said reaction mixture during cooling to obtain the desired grease grade.

Heat Stable Lithium-Lead Soap Composition, Patent #2,859,181 (T. B. Jordan and O. P. Puryear, assignors to The Texas Co.) A heat stable composition consisting essentially of a liquid vehicle comprising a highly refined mineral lubricating oil having a V.I. of at least 80 as the major component, 2 to 4 weight per cent lithium salt of hydroxy stearic acid, and 0.5 to 2 weight per cent of the lead salt of hydroxy stearic acid, the total concentration of said lithium and lead salts being not more than 6 weight per cent and not less than two weight per cent and finely divided iron powder in an amount betwen five and nine parts by weight of said liquid vehicle.

High Temperature Inorganic Gel Grease Compositions, Patent #2,860,104 (W. H. Peterson, S. T. Abrams and F. H. Stross, assignors to Shell Development Co.) A grease composition consisting essentially of a major amount of a mineral lubricating oil containing 1 to 25 per cent by weight, based on the total grease, of carbocyclic hydrocarbons having molecular weights within the range

of from about 300 to about 750, a grease-forming proportion of a grease-forming gel of the group consisting of amorphous inorganic colloids predominating in silica, hectorite and bentonite clays having adsorbed on the surface thereof a hydrophobing proportion of a cationic hydrophobic surface active agent, and onium hectorite and bentonite clays, and between about 0.5 percent and about 20 percent by weight of a compound selected from the group consisting of zinc oxide, zinc hydroxide, zinc borate and zinc carbonate.

Complex Grease Containing Inorganic Salt Thickener, Patent #2,861,043 (A. J. Morway and J. J. Kolfenbach, assignors to Esso Research & Engineering Co.) A lubricating grease composition comprising a major proportion of a lubricating oil and about five to 35 per cent by weight, based on the total composition, of a complex of an alkaline earth metal soap of a high molecular weight monocarboxylic acid having from about 12 to 30 carbon atoms per molecule, an alkaline earth metal salt of a low molecular weight monocarboxylic acid having about one to six carbon atoms per molecule, and an inorganic salt selected from the group consisting of alkaline earth metal nitrates and alkaline earth metal silicates, the molar ratio of low molecular weight carboxylic acid radicals to high molecular weight carboxylic acid radicals in said complex being about 7:1 to 25:1 and the proportion of said inorganic salt in said complex being in the range of about 10 to 50 percent by weight, said complex being prepared at a temperature of about 450 to 600F.

Prevention of Rust in Pipe Lines and Tankers with Acid-Type Wax Oxidate, Patent #2,826,803 (J. C. D. Oosterhout, assignor to The Texas Co.) A composition consisting essentially of a petroleum distillate having incorporated therein a rust inhibiting amount, oxidized macrocrystalline paraffin wax having a Neut. No. between 200-300, a Sap. No. between 282-430, a Neut. No. to Sap. No. ratio above 0.6, and an unsaponifiable content less than 40 per cent.

Emulsifiable Rust Preventive Concentrate, Patent #2,862,825 (R. A. Westlund, Jr. and C. E. Paxton, assignors to Esso Research & Engineering Co.) An emulsifiable rust preventive composition that forms a stable emulsion when admixed with one to 10 parts of water, consisting essentially of from 72.0 to 95.0 wt. per cent of a base material, from one to 10 wt. per cent of a coupling agent, and from one to 18 wt. per cent of a balancing agent, said base material consisting essentially of from about 10 to 25 wt. per cent of a mineral oil having a viscosity at 100F of about 90 to about 500 sus, about 10 to 25 wt. per cent of an alkali metal salt of a sulfonic acid having an average molecular weight of from about 420 to about 500 and about 20 to about 50 wt. per cent of a neutral degras, said coupling agent being selected from the group consisting of glycol ethers and polyglycol ethers having from about five to 15 carbon atoms and said balancing agent being selected from the group consisting of a mixture of a polyhydroxy amine and water having a water/amine ratio within the range of from 4/1 to 14/1 and a mixture of a polyalkylene derivative of a fatty amine having from 10 to 18 carbon atoms and water, said last mentioned mixture having a water/amine ratio of about 1/1 to 14/1, said percentages being based on the weight of the total composition.

Metal Amidophosphonate Greases, Patent #2,862,882 (B. W. Hotten and F. O. Johnson, assignors to California Research Corp.) A grease composition comprising a major proportion of an oil of lubricating viscosity and, in an amount sufficient to thicken said oil to the consistency of a grease, a metal salt of an amidophosphonate.

(Cont. on p. 80)

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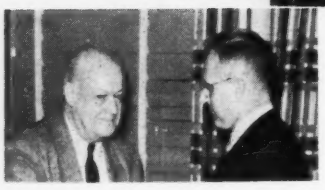
The January meeting of the Chicago Section was designated "Past Chairman's Night." All past chairmen of the section were presented with framed certificates similar to the above in recognition of their office.

E. W. Drummond, present chairman, presents certificate to A. B. Two, past chairman.

C. A. Bailey, first Chicago Section chairman, comments on early section meetings.



A. B. Wilder accepts certificate.

R. A. Kraus expresses his thanks for presentation.

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Membership in the American Society of Lubrication Engineers is in several grades as defined below. Assignment to grade is made by the Admissions Committee or Board of Directors on the basis of information submitted by the applicant.

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Centralized Lubrication in Production Foundries
(Cont. from p. 63)

The equipment was revised to enable the lubricant to penetrate the bearing and the bearing failure was eliminated.

On some of the centralized lubrication systems which have manually operated pumps, a check was made to determine if the equipment was cycled as per scheduled number of times per week. Counters were installed without the knowledge of the oilers responsible for operating the centralized systems. The oiler was properly instructed in the operation of the centralized system, however, it was discovered that he was not lubricating this equipment properly. Also, the oiler said he fully understood the basic operating principle of the equipment, but was omitting one simple basic step from the operating procedure by not allowing at least one minute for the system to vent itself before repeating the pumping cycle.

SUMMARY

Some of the centralized lubrication systems installed at the foundry and some of the experiences and problems encountered have been discussed. The performance of all of the different types of centralized lubrication systems have attained the high standard for which the equipment was designed. It has been definitely established that a centralized system prolongs the life of a bearing and less manpower is required for lubrication of the industrial equipment. The most important factors contributing towards a successful centralized system in a production foundry are as follows: Keep foreign matter from entering into lubricants, seal all pump reservoirs, and maintain strainers. Personal operating centralized systems must fully understand the basic operating principles. A means of recording the lubrication cycles performed by the centralized system is helpful.

A centralized system properly installed as well as properly maintained will pay a good dividend on its investment by reducing equipment wear, minimizing production delays, and by saving in manhours wasted by using old fashioned means of lubrication.

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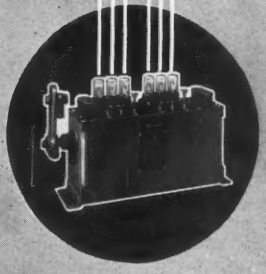

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PATENT ABSTRACTS

(Cont. from p. 77)

Production of Low Cold-Test Oils, Patent #2,862,868 (J. S. Brown and A. T. Jancosek, assignors to Standard Oil Co.) A method for dewaxing a wax-containing hydrocarbon oil having a viscosity between about 40 and 300 ssu at 100F, and a pour point between about 0 and 100F and obtaining a low cold-test oil therefrom having a pour point in the range of about −10 to −70F, which comprises contacting said oil with solid urea under urea-adduct forming conditions in the presence of between about 0.05 and 0.5 mole of methanol per mole of urea and between about two and 10 volume-percent of water based on said methanol, whereby urea adducts are formed from the waxes contained in said oil, and separating said urea adducts and any unreacted urea from the resulting reaction mixture, whereby a low cold-test oil of the desired pour-point range is obtained.

Lubricating Oil Compositions Containing Acylated Polyamine Salts, Patent #2,862,883 (J. Hughes and P. J. Garner, assignors to Shell Development Co.) A lubricating oil composition comprising a major amount of a mineral lubricating oil and a minor but detergent amount of an oil-soluble mono-acylated aliphatic polyamine salt of an aromatic acidic compound wherein the acidic radical is selected from the group consisting of phenolic hydroxy group, carboxylic acid and sulfonic acid.

Process for Anhydrous Calcium 12-Hydroxy Stearate and Estolide Containing Grease, Patent #2,862,884 (J. P. Dilworth, C. H. Culnane, Jr., and R. F. Nelson, assignors to The Texas Co.) The process of preparing a stable substantially anhydrous calcium base lubricating grease which comprises saponifying a hydroxy fatty acid material selected from the group consisting of substantially saturated mono- and dihydroxy fatty acids containing from about 12 to about 24 carbon atoms, and the glycerides thereof, with calcium hydroxide in the presence of a small amount equivalent to only a minor proportion of the liquid oleaginous lubricating base employed in the grease of a naphthenic distillate lubricating oil having a viscosity in the range from about 40 to about 600 seconds Saybolt Universal at 100F, heating the saponified mass at a temperature above the melting point of the soap for a time sufficient to substantially dehydrate the said mass, and thereafter gradually adding additional lubricating oil with continuous stirring as the said mass is cooled at a temperature below the melting point of the said soap, said hydroxy fatty acid material containing 3-15 per cent by weight of estolides having an average molecular weight in the range 800-1200.

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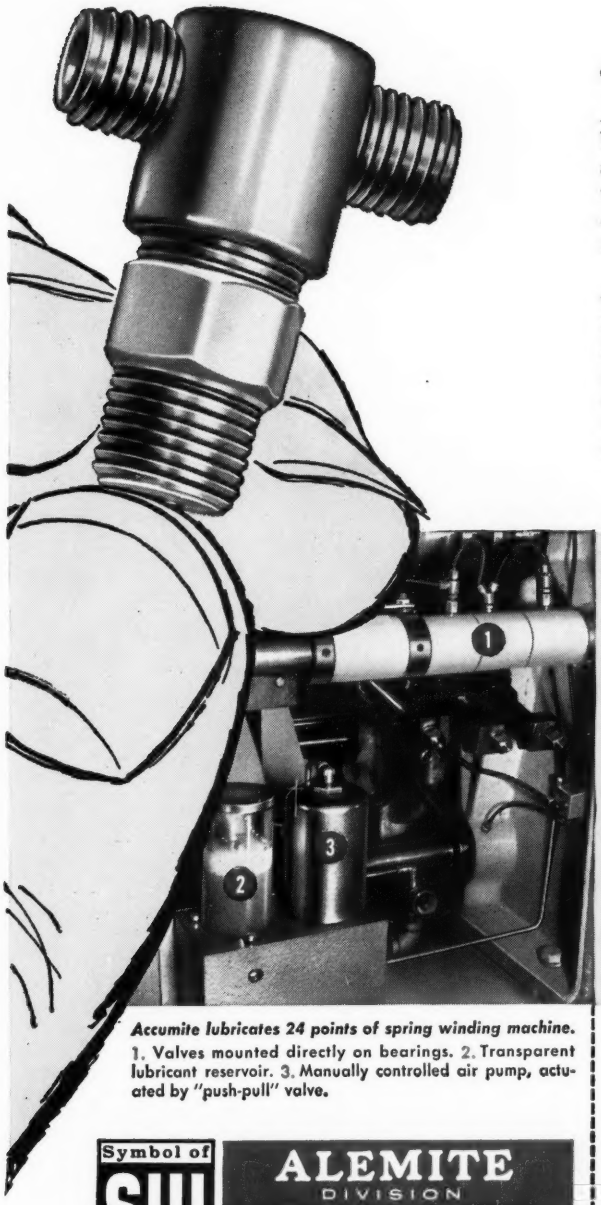

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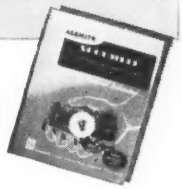

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